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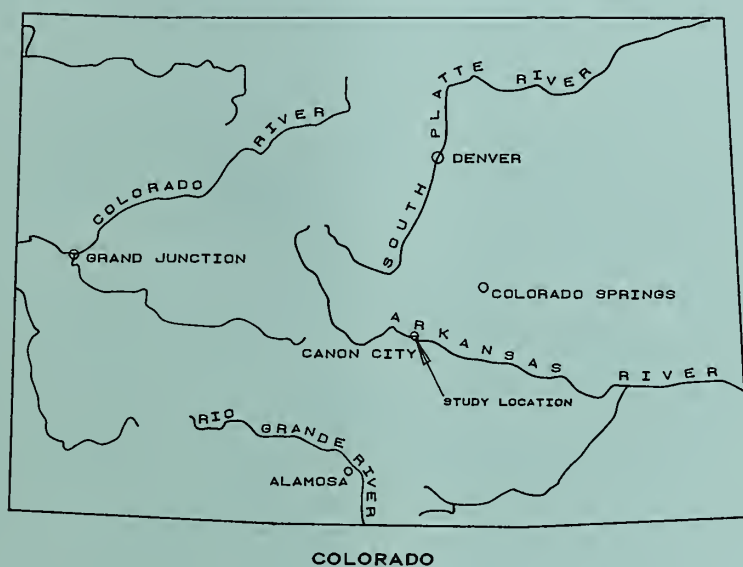
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NATURAL RESOURCES
CONSERVATION SERVICE

LAKEWOOD - COLORADO

FLOOD PLAIN MANAGEMENT STUDY FOUR-MILE CREEK & MUD GULCH AT CANON CITY, COLORADO



JUNE, 1996

**United States
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Agriculture**



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FOUR-MILE CREEK AND MUD GULCH AT CANON CITY
FREMONT COUNTY, COLORADO
FLOOD PLAIN MANAGEMENT STUDY

Prepared by the
U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Lakewood, Colorado
in cooperation with the
Colorado Water Conservation Board
Fremont County
City of Canon City

June, 1996

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PREFACE

This Report includes information on the flood hazard areas along the Four-Mile Creek and Mud Gulch near the City of Canon City, Colorado.

Because of the potential for flood damages, detailed flood hazard studies have been recognized as an essential item in guiding the use of flood plains. The purpose of this report is to provide adequate mapping and data for implementing flood plain management programs.

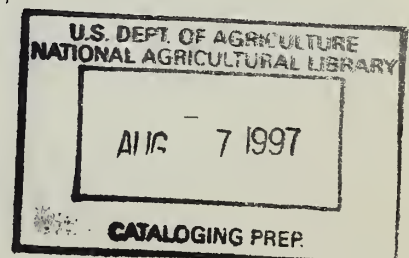
Rapid development is occurring near the City of Canon City as a result of population growth and economic expansion. The only flood plain information currently available is an approximate map prepared by the Federal Emergency Management Agency (FEMA). The available flood plain information is not suitable for guiding development and preventing structures from being built in the flood plain. Discussions with local residents, review of historic information, and field visits all indicate that there are definite flood problems in certain areas of the city.

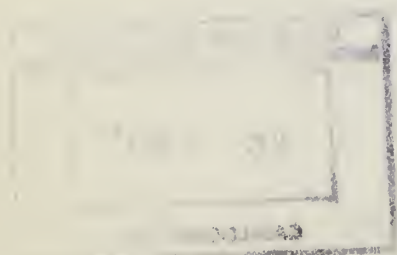
Included in this report are information on past floods, the potential for future floods, flooded area maps, water surface profiles, selected cross sections, peak discharge data, and recommendations for reducing potential flood damages.

The Natural Resources Conservation Service (formerly Soil Conservation Service) conducted the technical studies and prepared the report. These services were carried out in accordance with the Plan-of-Work of December, 1992.

The assistance and cooperation provided by the Colorado Water Conservation Board, Fremont County, and the City of Canon City are appreciated and gratefully acknowledged.

The field surveys, hydrologic, hydraulic, and other pertinent data and computations are on file with U.S. Department of Agriculture, Natural Resources Conservation Service, 655 Parfet Street, Lakewood, Colorado 80215-5517, telephone (303) 236-2903. Additional copies of this report may be obtained from the Natural Resources Conservation Service.





CIVIL RIGHTS AND CULTURAL RESOURCES IMPACT ANALYSES

CIVIL RIGHTS IMPACT ANALYSIS

A. Civil Rights Compliance

The program or activities conducted under this agreement will be in compliance with the nondiscrimination provision as contained in Titles VI and VII of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259), and other nondiscrimination statutes, namely, section 504 of the Rehabilitation Act of 1972, and the Age Discrimination Act of 1975. They will also be in accordance with regulations of the Secretary of Agriculture (7 CFR-15, Subparts A and B), which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or handicap, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

B. Demography of Study Area

According to the 1990 Census, the City of Canon City has a total population of 12,687 people. Their per capita income is at \$10,166 (in 1989 dollars). The constituents of the protected groups are as follows:

<u>Protected Groups:</u>	<u>Persons</u>	<u>Percent of Population</u>
Hispanics	999	7.9
African-American	171	1.3
American Indian, Eskimo, or Aleut	91	0.7
Asian/Pacific	43	0.3
Physically Challenged	1,835	14.5 (1)
Female	6,571	51.8

C. Property Values

The values of the homes located along the study reaches varied from \$70,000 to \$170,000.

D. Impact Analysis

This flood plain management study has no negative impact on the protected groups. It only helps them in protecting their lives and preventing losses of their personal properties which may result in an event of flooding.

CULTURAL IMPACT ANALYSIS

The Canon City's Flood Plain Management Study does not impact cultural resources or affect historic properties. In accordance to NRCS GM 420 Part 401.3a1 this project assistance is not considered an undertaking. However, if any actions are taken that could have any adverse effects on a site, the action will stop until applicable provisions of Public Law 93-291 and/or Public Law 89-665 have been complied with. Applicable state laws dealing with archaeological and historic site preservation will also be complied with.

(1) Civilian non-institutionalized persons 16 years or older

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INTRODUCTION

This flood plain management report was prepared by the U.S. Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Colorado Water Conservation Board, Fremont County, and the City of Canon City, Colorado. Interpretations of the flood plain management study and recommendations to reduce damages are included; however it is beyond the scope of this report to provide detailed proposals or plans to rectify the flooding problems.

A. OBJECTIVES

The objective of this study is to provide detailed flood plain management information and mapping to the Fremont County and City of Canon City for use in implementation of flood plain management programs which will minimize potential flood losses. Included in the report are engineering and hydrologic data which will facilitate the development of a flood plain management plan, road and bridge designs, and flood control measures (if needed).

B. AUTHORITY

Section 37-60-106(1), Colorado Revised Statutes, authorizes the Colorado Water Conservation Board "To designate and approve storm or floodwater runoff channels or basins, and to make such designations available to legislative bodies of cities and incorporated towns, to county planning commissions, and to boards of adjustment of cities, incorporated towns, and counties of this state". The board provides assistance to local governments in development and adoption of effective floodplain ordinances. In addition, the board will provide technical assistance to local entities during the performance of floodplain information studies within Colorado. Presently, direct financial assistance for the performance of floodplain studies is no longer available from the board.

Section 30-28-111 C.R.S. for county governments and Section 1-23-301 C.R.S. for municipal governments of the Colorado Revised Statutes state the cities, incorporated towns, and counties within the study area may provide zoning regulations "... To establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin that has been designated and approved by the Colorado Water Conservation Board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters ..."

Therefore, upon official approval of this report by the Colorado Water Conservation Board, the areas described as being inundated by the 100-year flood can be designated as flood hazard areas and their use regulated accordingly by the local governments.

Flood plain management studies are carried out by the Natural Resources Conservation Service as an outgrowth of the recommendations in A Report by the Task Force on Federal Flood Control Policy, House Document No. 465 (89th Congress, August 10, 1966), especially Recommendation 9(c), Regulation of Land Use, which recommended the preparation of preliminary reports for guidance in those areas where assistance is needed before a full flood plain information report can be prepared or where a full report is not scheduled.

Authority for funding flood plain management studies is provided by Section 6 of Public Law 83-566, which authorizes the U.S. Department of Agriculture to cooperate with other federal, state and local agencies to make investigations and surveys of the watersheds and rivers and other waterways as a basis for the development of coordinated programs. In carrying out flood plain management studies, the Natural Resources Conservation Service is being responsive to Executive Order 11988, entitled "Flood Plain Management", and Executive Order 11990, entitled "Protection of Wetlands" (both effective May 24, 1977).

DESCRIPTION OF STUDY AREA

A. Basin Characteristics

The watersheds that produce runoff to Four-Mile Creek in Canon City are large in size (total area: 434 sq. miles). They are mostly woodland and some rangeland in fair to poor condition, with exception of the area near the Four-Mile Creek and Arkansas River confluence, where land are mainly cultivated agricultural land. The Mud Gulch's watersheds are much smaller (total area: 3.61 sq. miles). They are mostly agricultural land and range land in fair to poor condition.

The Four-Mile Creek flows southerly out of the Pike National Forest; whereas, the Mud Gulch flows southerly out of a small local drainage. They both join the Arkansas River at Canon City. The Mud Gulch watershed includes a RC&D dam which was built for flood control.

The soils in the 4-Mile Creek and Mud Gulch basins can be described in two categories:

(1) "Soils on the Plains" makes up 11 percent of Fremont County. They are level and steep. Elevation is 5,000 to 6,000 feet - where average annual precipitation is 12 inches. These soils are mostly of hydrologic soil complex group D, with some B and C. They are shallow to deep and are well drained. They formed in alluvium derived mainly from shale, limestone, and eolian sands and silt and in residuum derived dominantly from shale and limestone. The soils are used mainly for irrigated crops, hay and pasture, or orchards. They are also used as rangeland.

(2) "Soils and Rock Outcrop on Mountains" - this group makes up about 46 percent of the county area. The soils are gently sloping to extremely steep. Elevation is 6,800 to 11,600 feet. The average annual precipitation is 16 to 18 inches. These soils are of hydrologic soil complex group D. These soils are shallow to deep and are well drained. They formed in residuum, colluvium, glacial outwash, till, and alluvium derived dominantly from igneous, metamorphic, and sedimentary rocks. The soils are used mainly for woodland, wildlife habitat, livestock grazing, recreation, or rangeland.

The vegetation in the upper watersheds of 4-Mile Creek and Mud Gulch are predominantly range land with some woodland and many outcrop areas. The lower quarter section of the basins is occupied by residential and some commercial properties.

The flood plains, within the study limits, generally contain typical residential and commercial property improvements such as buildings, yards, fences, streets, vehicles, etc. Vegetation such as orchards,

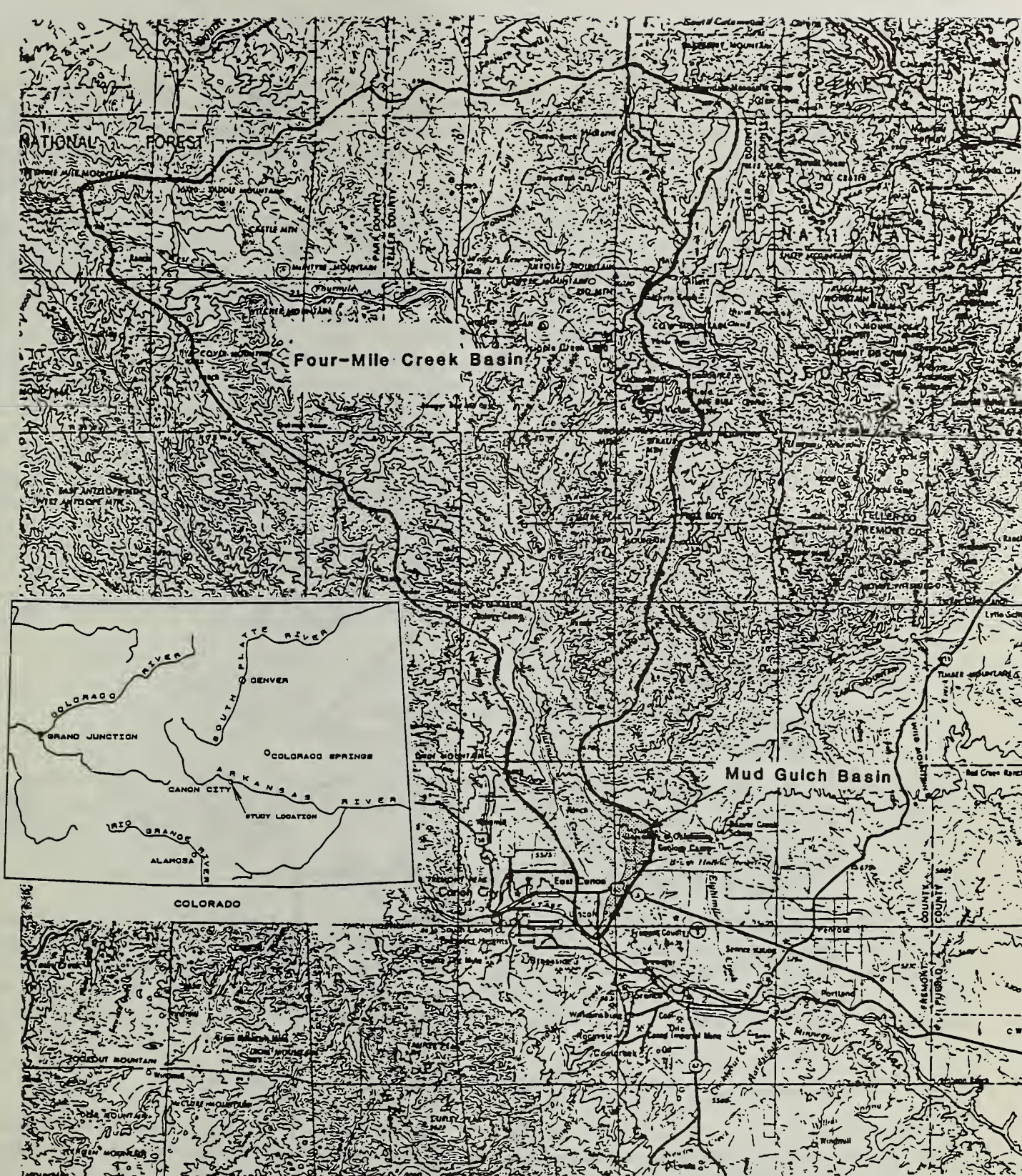


Figure 1. WATERSHED MAP

Four-Mile Creek and Mud Gulch

Flood Plain Management Study

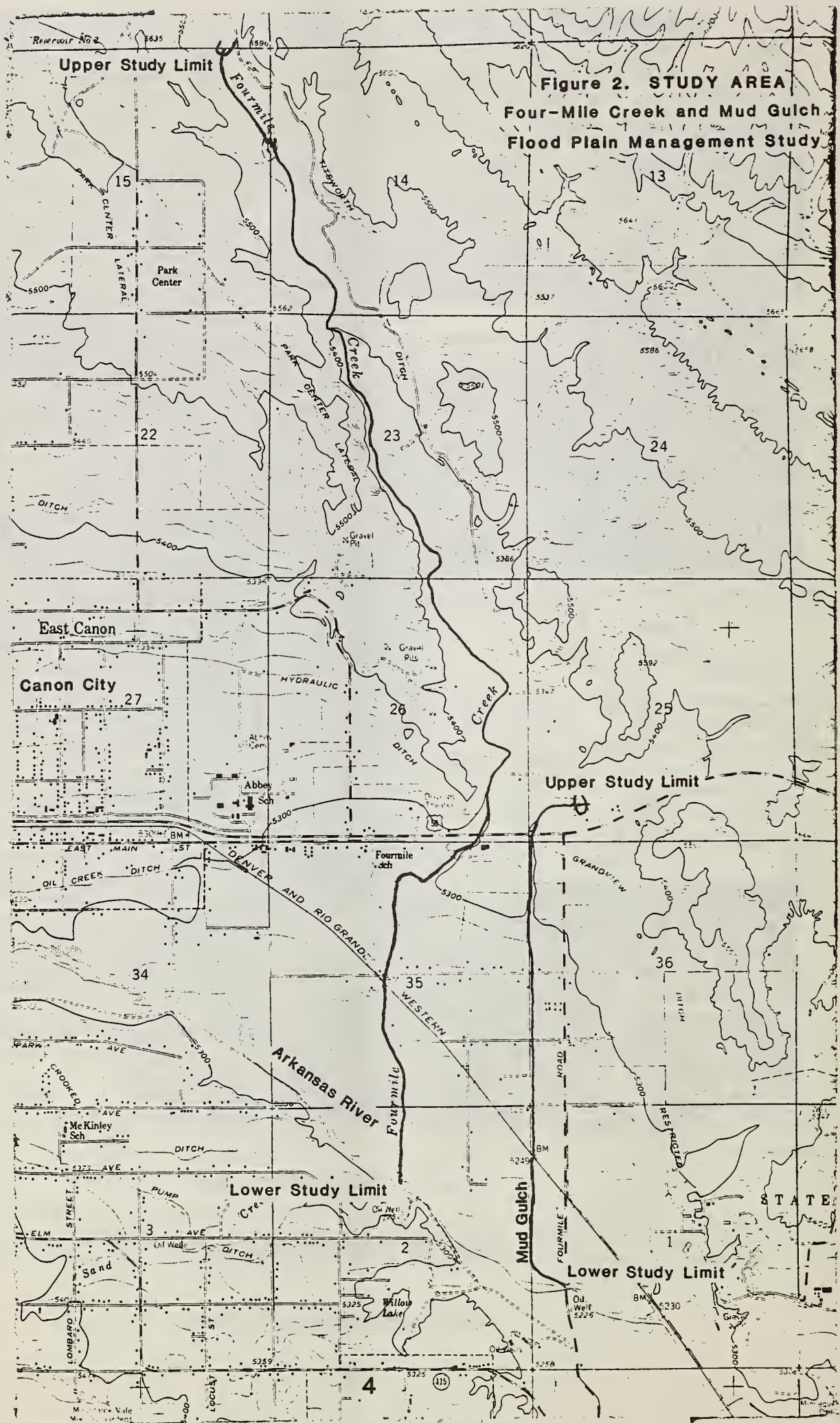


Figure 2. STUDY AREA
Four-Mile Creek and Mud Gulch
Flood Plain Management Study

lawns, shrubs, trees, flowers, and forbes are a part of the landscape. There are some willows and cottonwoods along those channels that have a sustained water supply. The channel does a considerable amount of meandering which enhances the visual aesthetics and wildlife habitat values in the area.

The mean annual precipitation for the basin ranges from 12 to 18 inches. A precipitation station which is located at an elevation of 5343 ft, near the Warden Penitentiary in Canon City, has a mean annual precipitation of 12.57 inches with August accounting for the greatest average monthly rainfall value of 1.88 inches. Snowfall does occur throughout the winter period however there is no large accumulation. An analysis into the contribution of spring snowmelt to flooding suggests it is not a significant factor. Late spring and summer rains are the most likely to produce flooding in the study area.

B. Limits of Study Areas

The study includes all the Four-Mile Creek drainage from the west boundary of Section 14, T18S, R70W, to its confluence with the Arkansas River and the Mud Gulch drainage from the Four-Mile Lane bridge north of Highway 50 to its confluence with the Arkansas River. This includes the following reaches:

<u>Reach Name</u>	<u>Reach Length</u>
Four-Mile Creek	4.55 miles
Mud Gulch	2.05 "
<hr/>	
Total Reach Length:	6.60 miles

An index map showing the location of flood plain mapping is included as figure 3. The flood plain maps themselves are shown as sheets 1 thru 7 following the index map.

RELATED FLOOD STUDIES

A detailed Flood Plain Information Report was done in December 1981, by Camp Dresser & McKee Incorporated of Denver, Colorado, in cooperation with the Colorado Water Conservation Board. This report only presented the flood plain information on the Arkansas River in the Town of Florence, the City of Canon City, and in Fremont County between Florence and Canon City.

FLOOD HISTORY

There have been numerous floods in the past 100 years, the impact of which has increased in recent years due to continued development in the flood plains. Information from local residents, newspaper, and the Weather Bureau shows that flash flooding has occurred in 1906, 1921, 1929, 1930, 1934, 1935, 1947, 1948, 1954, 1956, 1957, 1961, 1965, 1966, 1974, 1977, and 1991. Based on a damage assessment done in 1977 by Joe Alessi of N.R.C.S., the 1974 flood caused more than \$250,000 in damage to the east of Canon City.

Flooding along Four-Mile Creek and Mud Gulch occurs as a result of local storms on the watersheds above the City. An example of local flooding is the flood of August 12, 1991. This particular event was not an extreme

flood, but it did cause some street and rail-road damages as well as damage to private property - which included extensive water damage in basements and a few fences that were destroyed or washed away. Water up to four feet deep was reported along the Central Avenue. Many homeowners spent time to clean mud from their yards and driveways.

Precipitation records are incomplete however there are data for one period from 1940 to 1984 for the Canon City location. The greatest one day recorded rainfall occurred in 1955 (2.74 inches). There were ten occurrences of 2.0 or more inches of rainfall during the period of record.

INVESTIGATIONS AND ANALYSIS

A. Interpretation and Use of Report

1. **Frequency and Discharge:** The 10-year, 25-year, 50-year, 100-year, and 500-year flood events are used as the flood frequencies for this flood plain analysis. Thus, the data developed in this report will be suitable not only for regulation purposes, and H.B. 1041 designation but is also consistent with the Federal Insurance Administration flood insurance studies conducted by the Federal Emergency Management Agency.

These various flood events have an average occurrence of once in the number of years as indicated. For example, the 100-year flood occurs, on the average, once in a 100-year period, and has one percent chance of being equaled or exceeded in any given year.

The particular uses for the various flood events in addition to those stated above are as follows:

10-year, 25-year, and 50-year Flood Events

Information regarding these lower frequency floods is especially useful for future engineering studies and land-use planning purposes related to minor road systems, minor channel improvements, the location of parks and recreational facilities, agricultural lands, and appurtenant structures. The use of the lower frequency floods may be considered in planning flood prevention projects to protect agricultural areas, or other property where risk to life is not a factor.

100-Year Flood Event

The 100-year flood event may be used in lieu of lower frequencies for engineering design purposes where greater security from flooding is desired.

However, the most important use of the 100-year flood event lies in flood plain management and land-use planning as set forth in the state statutes. The State of Colorado and the Federal Government consider the 100-year frequency flood as the flood event to be used in designing and protecting structures and dwellings for human occupation. Therefore, all flood plain regulations are based on the 100-year flood.

500-year Flood Event

The 500-year flood event may be used to show the upper level of flood plain management, or for a certain critical type of construction such as

one that involves water or sewage treatment plants. The 500-year flood event can be used to provide an upper level of safety.

2. Flood Elevation: Water surface elevations for the 10-year, 25-year, 50-year, 100-year, and 500-year floods, as determined at each cross-section, may be found in Table 3 - "Flood Frequency-Elevation and Discharge Data". The flood profile data (sheets 1P through 25P) show a graphical relationship of water surface elevations along the stream reaches for the given frequencies. Selected typical cross-sections from different reaches within the study area are shown on sheets 1X through 3X.

The flood profiles may be used in areas where controversy arises over the 100-year flood boundary shown on the Flood Plain Maps. Since the flood profile exhibits give the water surface elevation at a specific point on the reference line, the flood elevations can be surveyed on the ground to alleviate any discrepancies on the base map.

3. Flooded Areas: Flood plain maps, sheets 1 through 7, show the boundary of the 100-year flood plain. The flood plain boundary was plotted using flood contour elevations and stationing from the plotted flood profiles. This was done at elevation intervals compatible with the map contour intervals. Flood contours are shown as wiggly lines at two-foot intervals and perpendicular to the direction of flow.

B. HYDROLOGY

The watersheds that produce runoff to Four-Mile Creek in Canon City are large in size (total area: 434 sq. miles). The Mud Gulch's watersheds are much smaller (total area: 3.61 sq. miles). Slopes range from 3 percent to 20 percent and greater.

The Four-Mile Creek flows southerly out of the Pike National Forest; whereas, the Mud Gulch flows southerly out of a small local drainage. They both join the Arkansas River at Canon City. The NRCS TR-20 (Computer Program for Project Formulation Hydrology) was used in frequency flow calculations for Mud Gulch. Four-Mile Creek's discharges were computed by regional analysis.

Snow Melt Analysis - The effect of snow melt on runoffs was investigated. The U.S. Army Corps of Engineers computer program HEC-1 was used to test the contribution snow melt made to peak discharges. Results show that snow melt is not a contributing factor to runoff frequencies of 10-year or greater, which is the primary concern of this study. This implies that significant runoff is coming from rainfall events. As a consequence, only rainfall generated runoff is considered in developing peak discharge-frequency values included herein.

Frequency Analysis - Initially, frequency discharges for Four-Mile Creek were determined by the Log Pearson Type III frequency analysis (Bulletin 17B) of the USGS stream gage data (the gage is located on Four-Mile Creek, 3100 ft from the Arkansas River), but the results were inadequate because the data record of Four-Mile watershed did not include sufficient historical peaks. Further research in the archives of the Canon City Historical Society, in an attempt to recover the missing records, did not yield any result.

1. Four-Mile Creek's Hydrology: Frequency discharges were computed by regional analysis of seven stream gages in the Arkansas River Basin and four in the Platte River Basin. These gaged stations have twenty or more years of reliable data and record peak flows unaffected by regulation or diversion (with some exception on Four-Mile Creek's gage). Omitted from the study were gages at locations above 8000-foot or below 4000-foot elevation, urban gages, gage with upstream regulation, gages with less than twenty years of record, and gages located on streams with topographic features markedly dissimilar to those of the Four-Mile watershed.

Table 1 shows the seven selected gages from the Arkansas River Basin and the four selected gages from the Platte River Basin, as well as the drainage area of each gaged basin, and the number of years of recorded annual peak data. The drainage areas for the selected stream gages vary from 86.6 to 1320 sq. miles and the gage elevations are from 4100 feet to 6910 feet.

GAGE	LOCATION	W/S AREA (Sq. Mi.)	Years of Record	Sta. Ave. Skew
06700500	Goose Creek above Cheesman Lake	86.6	58	0.05
06707000	North Fork South Platte River	479	72	0.05
06709500	Plum Creek near Louviers	302	41	0.05
06710500	Bear Creek at Morrison	164	81	0.05
07096500	Four-Mile Creek near Canyon City	434	26	0.36
07106000	Fountain Creek near Fountain, CO	681	23	0.11
07119500	Apishapa River near Fowler, CO	1125	57	0.00
07121500	Timpas Creek at Swink, CO	496	28	0.00
07122400	Crooked Arroyo near Swink, CO	108	24	0.00
07124500	Purgatoire River at Trinidad, CO	795	69	0.00
07126000	Purgatoire River near Alfalfa, CO	1320	22	0.00

Table 1 - Regional Analysis of U.S. Geological Survey's Stream Gages

The linear equations for Four-Mile Creek's discharges are:

	<u>Corr. Coefficient</u>
$Q(10) = 10^{[1.419327 \cdot \text{Log}(A) - 0.095560]}$	0.91
$Q(25) = 10^{[1.390321 \cdot \text{Log}(A) + 0.186880]}$	0.88
$Q(50) = 10^{[1.363207 \cdot \text{Log}(A) + 0.394743]}$	0.84
$Q(100) = 10^{[1.334726 \cdot \text{Log}(A) + 0.594275]}$	0.80
$Q(500) = 10^{[1.260348 \cdot \text{Log}(A) + 1.048243]}$	0.68

Where watershed area A = 434 sq. miles

GAGE ID	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr(*)
07096500	4,445	7,142	9,777	13,019	23,572

(*) $Q(500) = 23,200$ cfs (by graph) is recommended for use.

2. Mud Gulch's Hydrology: TR-20 computer program model was used in calculating frequency flows for the Mud Gulch basin.

*** Precipitation P** - The historical station precipitation data was used as input to the TR-20 model. No areal adjustments were made because of the small drainage areas involved. The Natural Resources Conservation Service (NRCS) 24-hour Type IIA rainfall distribution was selected for use in the model to generate frequency peak discharges.

*** Runoff Curve Numbers CN's** - Hydrologic runoff curve numbers (CN's) were developed from the NRCS soil map, land use information, and field observations. CN values for the TR-20 watersheds reflect weighted average CN's for a variety of land uses and soils within each watershed.

*** Time of Concentration Tc** - Time of concentration values were computed for the Mud Gulch sub-basins from an empirical equation in the Natural Resources Conservation Service's Engineering Field Manual - Chapter Two, intended for small rural watersheds.

$$T_c = (L^{0.8} \times [(1000/CN) - 9]^{0.7}) / (1140 \times Y^{0.5})$$

Where,

Tc = Time of concentration (in hours)

L = Flow length (in feet)

CN = Run off curve number

and **Y** = $100CI/A$

Where,

Y = Average watershed slope (in percent)

C = Total contour length (in feet)

I = Contour interval (in feet)

A = Drainage area (in sq. feet)

*** Base flow** - A Base flow value of 25 cfs was obtained from the local irrigation annual record. This base flow accounts for the inflow from the Oil Creek Ditch which enters Mud Gulch at a point 6,700 feet upstream from the Arkansas River.

The TR-20 peak discharge values for Mud Gulch and the Four-Mile Creek frequency flows which were developed by regional analysis, were used in conjunction with U.S. Army Corps of Engineers' HEC-2 model in hydraulic analyses to develop water surface profiles and flood plain maps.

C. HYDRAULICS

Hydraulic analyses conducted in this study were done using the U.S. Army Corps of Engineers computer model HEC-2 Water Surface Profiles. All flows were set up as subcritical flows in compliance with FEMA's 1985 guidelines and specifications.

Discharge values were discussed in the hydrology section of this report. Most of the cross-section data were hand-picked from topographic maps with a scale of 1 inch = 200 ft with 2-foot contour intervals. Dimensions of bridges and hydraulic roughness coefficients (n values) were determined from field investigations. Tables 2a and 2b show the estimated n values for HEC-2 cross-sections of Mud Gulch and Four-Mile Creek.

HEC-2 Cross-Sections	n Values		
	Left Overbank	Channel	Right Overbank
34 - 39.5	0.045	0.045	0.045
40 - 170	0.050	0.050	0.050
180 - 190	0.045	0.045	0.045
200 - 255	0.040	0.040	0.040

Table 2a - Estimated n Values for Mud Gulch's Channel Cross-Sections

HEC-2 Cross-Sections	n Values		
	Left Overbank	Channel	Right Overbank
40 - 160	0.045	0.045	0.045
170 - 240	0.040	0.040	0.040
250 - 700	0.045	0.045	0.045

Table 2b - Estimated n Values for Four-Mile Creek's Channel Cross-Sections

The 100-year and 500-year water surface elevations for cross-sections 34 were chosen, based on a previous flood study done by Camp Dresser and McKee Inc.

For some cross-section, its end points were either dog-legged and extended up-slope to close or just being left alone and allowed the HEC-2 program to extend the end points' elevations automatically. Also note that because of the wideness of the overbank areas; in an event of bank overflow, the channels would behave more like a storage than a channel flow.

The 4-Mile Creek's 100-year and 500-year computed water surface elevations were used in place of the Mud Gulch's at cross-sections 40 through 110. The 100-year and 500-year water surface elevations for Mud Gulch's cross-sections 34 through 39.5 were obtained by interpolation.

At some other cross-sections, as indicated in table 3, the water surface elevations were interpolated to obtain smoother flood profiles.

Inserted cross-sections, at or near bridges and culverts, are not shown on the flood maps because they were used mainly for HEC-2's structural modeling. The elevations of these inserted sections were interpolated from either a upstream's or a down-stream's cross-section near the structure.

At some cross-section, the channel segment was re-aligned to be perpendicular to the direction of stream flow; though this re-alignment might not be shown on the flood map.

Water surface profiles, typical cross-sections, and maps showing the 100-year flood boundaries are shown on included exhibits and flood plain maps. Table 3 shows computed flood elevations at specific cross-sections.

No HEC-2 Floodway Analysis was done; therefore, the 500-year flood lines were not shown on the flood plain maps. This was agreed upon by the City of Canon City and Colorado Water Conservation Board.

Flood boundaries were located on the set of topographic maps, previously referred to, by transferring flood elevations (at map contour intervals) from plotted profiles (from HEC-2) to the maps using stationing along the main channel as the location reference. These points were connected and smoothed to create the maps' flood boundaries.

FLOOD PLAIN MANAGEMENT

Potential flood damages to existing development and possible loss of life can be alleviated or lessened through non-structural and structural flood hazard mitigation methods.

Non-structural methods include: Local flood plain regulations, land treatment, flood warning and forecasting systems, flood insurance, flood proofing, flood fighting and emergency evacuations.

A. Local Regulations

The need to minimize property damage due to flooding has been recognized by planners and local community officials. Subdividers and developers are required to submit proposed storm drainage plans to the planning commission for approval. In the past, drainage plans have been prepared singularly or on a plat-by-plat basis. Information contained in this report will be useful in developing a master drainage plan for the study area. This report provides the outline of flood hazard areas on large scale maps specifically for this purpose.

The City may provide zoning regulations "... To establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin, as such storm or floodwater runoff channel or basin has been designated and approved by the Colorado Water Conservation Board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters..." as stated in Section 30-28-111 for county governments and Sections 31-23-302 for municipal governments of the Colorado Revised Statutes.

B. Colorado Natural Hazard Area Regulations

In 1974, the Colorado General Assembly passed House Bill 1041, a bill "Concerning land use, and providing for identification, designation, and administration of areas and activities of State interest..." (H.B. 1041, Title 24, Article 65.1, C.R.S., as amended). Areas of State interest include natural hazard areas, or those areas that are "So adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property". Flood plains are natural hazard areas.

With reference to the administration of natural hazard areas, Section 24-65.1-202(2)(a) of the Act provides: Flood plains shall be administered so as to minimize significant hazard to public health and safety or to

property; open space activities shall be encouraged; structures shall be designed in terms of use and hazards; disposal sites and systems shall be discouraged which, in time of flooding, would create significant hazards to public health and safety or to property.

The Act further provides that after promulgation of guidelines for land use in natural hazard areas..., the natural hazard areas shall be administered by local government in a manner which is consistent with the guidelines for land use in each of the natural hazard areas.

C. Colorado Water Conservation Board Designation

Concerning the designation of the flood plain, the Colorado Water Conservation Board is charged with the primary responsibility for:

1. Making recommendation to local governments and the Colorado Land-Use Commission.
2. Providing technical assistance to local governments.

The Board's power and duty is...

"... To devise and formulate methods, means and plans for bringing about the greater utilization of the waters of the State and prevention of flood damages therefrom, and to designate and approve storm or floodwater runoff channels or basins, and to make such designations available to legislative bodies of cities and incorporated towns, to county planning commissions, and to boards of adjustment of cities, incorporated town, and counties of this state..."

As stated in Section 37-60-106 (1)(c) of the Colorado Revised Statutes.

Upon review and approval of this report, the Colorado Water Conservation Board will designate and approve as flood plain areas those areas inundated by the 100-year flood as described by the floodwater surface elevations and profiles in this report. The use of the designated flood plain areas may then be regulated by the local government.

D. Model Regulations

Model flood plain regulations have been promulgated by the Colorado Water Conservation Board, with the purpose to promote public health, safety, and general welfare, and minimize flood hazards and losses. The model includes provisions designed to:

1. Promote sound planning and permit only such uses within flood plains that will not endanger life, health, and public safety or property in times of flooding.
2. Protect the public from avoidable financial expenditures for flood control projects, flood relief measures, and the repair and restoration of damaged public facilities.
3. Prevent avoidable interruption of business and commerce.
4. Minimize victimization of unwary home and land purchases.
5. Facilitate the administration of flood hazard areas by establishing requirements that must be met before use or development is permitted.

The Board's model flood plain regulations offer two options for management of the 100-year flood plain. These are the Hazard Area Concept and the Floodway Concept.

The Hazard Area Concept defines the areas of the flood plain in which waters of the 100-year flood attain a maximum depth greater than one and one-half feet as a high hazard area, and a depth less than this as a low hazard area.

The Floodway Concept defines the channel of a stream and adjacent flood plain areas that must be kept free of development in order to safely pass the 100-year flood with a minimal rise in the water surface elevation. The rise must be no more than one foot to meet the federal standards.

E. Flood Insurance

The National Flood Insurance Act of 1968 (Title XIII of the Housing and Urban Development Act, P.L. 90-448) recognized the necessity for flood plain management. This Act makes federally subsidized insurance available to citizens in communities that adopt regulations controlling future developments of their flood plain. With respect to encroachment on the flood plain, the regulations require:

1. New residential construction or substantial improvement of existing homes must have the lowest floor level at or above the elevation of the 100-year flood.
2. Non-residential construction must meet the same standard or be flood proofed to that level.

The 1968 Act benefits owners of structures already in the flood-prone areas by providing insurance coverage that had been unavailable through private companies. The Act created a cooperative program of insurance against flood damage by the private flood insurance industry and the federal government.

The amount of coverage available and the premium rate varies considerably depending on property location within the flood plain and the property value. All property owners shown in this study to be within areas subject to flooding should consider the purchase of flood insurance.

Additional information on the Flood Insurance Program is available from local insurance agents, brokers, or FEMA at the following address:

Federal Emergency Management Agency, Region VIII
Natural and Technological Hazard Division
Denver Federal Center, Building 710
Denver, CO 80225
Telephone: 235-4830

The National Flood Insurance Program used the Floodway Concept in its rate studies for communities participating in the regular phase of the program.

F. Flood Warning and Flood Forecasting System

The National Oceanic and Atmospheric Administration (NOAA) through its National Weather Service Agency (NWS), maintains year-round surveillance

of weather and flood conditions. Daily weather forecasts are issued through the NWS and disseminated by radio and television stations. A general alert to the danger of flash flooding is one of the service provided by the NWS.

The Office of the Colorado State Engineer, Division of Water Resources, in cooperation with the National Weather Service, operates a state-wide flood warning system utilizing 78-stream gaging stations that are part of the Colorado satellite-linked water resources monitoring network operated by the State Engineer.

G. Evacuation Plan

An "Emergency Evacuation and Operations Plan" would provide for alerting the public of potential flooding, and coordinating community and county services during an emergency. Planning implementation during the time of an emergency requires cooperation of the general public as well as local officials. This is especially important for flood fighting, evacuation, and rescue operations. Communication is extremely important during flood alerts. Warnings issued through the NWS are disseminated by radio to state and local officials.

RECOMMENDATIONS

The following recommendations are included for consideration in reducing potential flood damages:

1. Carry out periodic maintenance of bridges and culverts to preserve their hydraulic capacity.
2. Implement design recommendations included in the "Drainage Master Plan for the City of Canon City".
3. Do detailed study of need for flood proofing around facilities in the flood plain or consider flood insurance.
4. Information and education programs on flood hazards should be made available to the public.
5. The main channels should be maintained to preserve a balance between native vegetation, conveyance capacity, channel stability, and provide wildlife habitat.

In compliance with Section 404 of the Clean Water Act, administered by the U.S. Army Corps of Engineers, it is the responsibility of the City of Canon City to contact the Corps of Engineers before implementing any recommendation in a water of the U.S..

- - - * - - -

GLOSSARY OF TERMS

CHANNEL - A natural or artificial water course of perceptible extent with definite banks to confine and conduct continuously or periodically flowing water. Channel flow is that water which is flowing within the limits of the defined channel.

FLOOD - Water from river, stream, water course, lake or other body of standing water, that temporarily overflows the boundaries within which it is ordinarily confined.

FLOOD CREST - The maximum stage or elevation reached by the waters of a flood at a given location.

FLOOD FREQUENCY - A means of expressing the probability of flood occurrences as determined from statistical analysis of representative stream flow or rainfall and runoff records. The frequency of a particular stage or discharge is usually expressed as occurring once in a specified number of years. The 10-year, 25-year, 50-year, 100-year, and 500-year frequency floods have an average frequency of occurrence in the order of once in the number of years indicated.

FLOOD HAZARD AREAS - Areas susceptible to flood damage.

FLOOD PEAK - The highest stage or discharge attained during a flood event; also referred to as peak stage or peak discharge.

FLOOD PLAIN - The relatively flat or lowland area adjoining a river, stream, watercourse, lake, or other body of water which has been or may be covered temporarily by flood water. For administrative purposes the flood plain may be defined as the area that would be inundated by the 100-year flood.

LEFT or RIGHT STREAM BANK - The left or right bank of the stream looking downstream.

PERCHED CHANNEL FLOW - A condition where the flow elevation in the outer portions of the flood plain is higher than the flow elevation in the main channel. This condition occurs when a secondary channel receives inflow from some location upstream and maintains a flatter slope than the main channel.

REACH - A hydraulic engineering term used to describe longitudinal segments of a stream or river.

RUNOFF - That part of precipitation, as well as any other flow contributions, which appears in surface streams of either perennial or intermittent form.

STREAM - Any natural channel or depression through which water flows whether continuously, or intermittently, including modification of the natural channel or depression.

STRUCTURE - Anything constructed or erected, the use of which requires a more or less permanent location on or in the ground. Includes but is not limited to bridges, buildings, canals, dams, ditches, diversions, irrigation systems, pumps, pipelines, railroads, roads, sewage

disposal systems, underground conduits, water supply systems and wells.

VALLEY CROSS-SECTION - A plotting of the topography of a stream channel and adjoining landscape as viewed perpendicular to the flow in a downstream direction. The plotting represents a specified location within a designated stream reach.

WATER OF THE UNITED STATES - Waters which are (or have been) used for interstate or foreign commerce including waters subject to the ebb and flow of the tide; interstate waters, (including wetlands); lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, including tributaries to any of these waters. Also included are irrigation canals.

WATER SURFACE PROFILE (This term is synonymous with FLOOD PROFILE) - A graph showing the longitudinal relationship of the water surface elevation of a flood event to location along a stream or river.

WATERSHED - A drainage basin or area which contributes to runoff and transmits its usually by means of streams tributaries to the outlet of the basin.

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CANON CITY, FREMONT COUNTY
FOUR-MILE CREEK AND MUD GULCH
FLOOD PLAIN MANAGEMENT STUDY

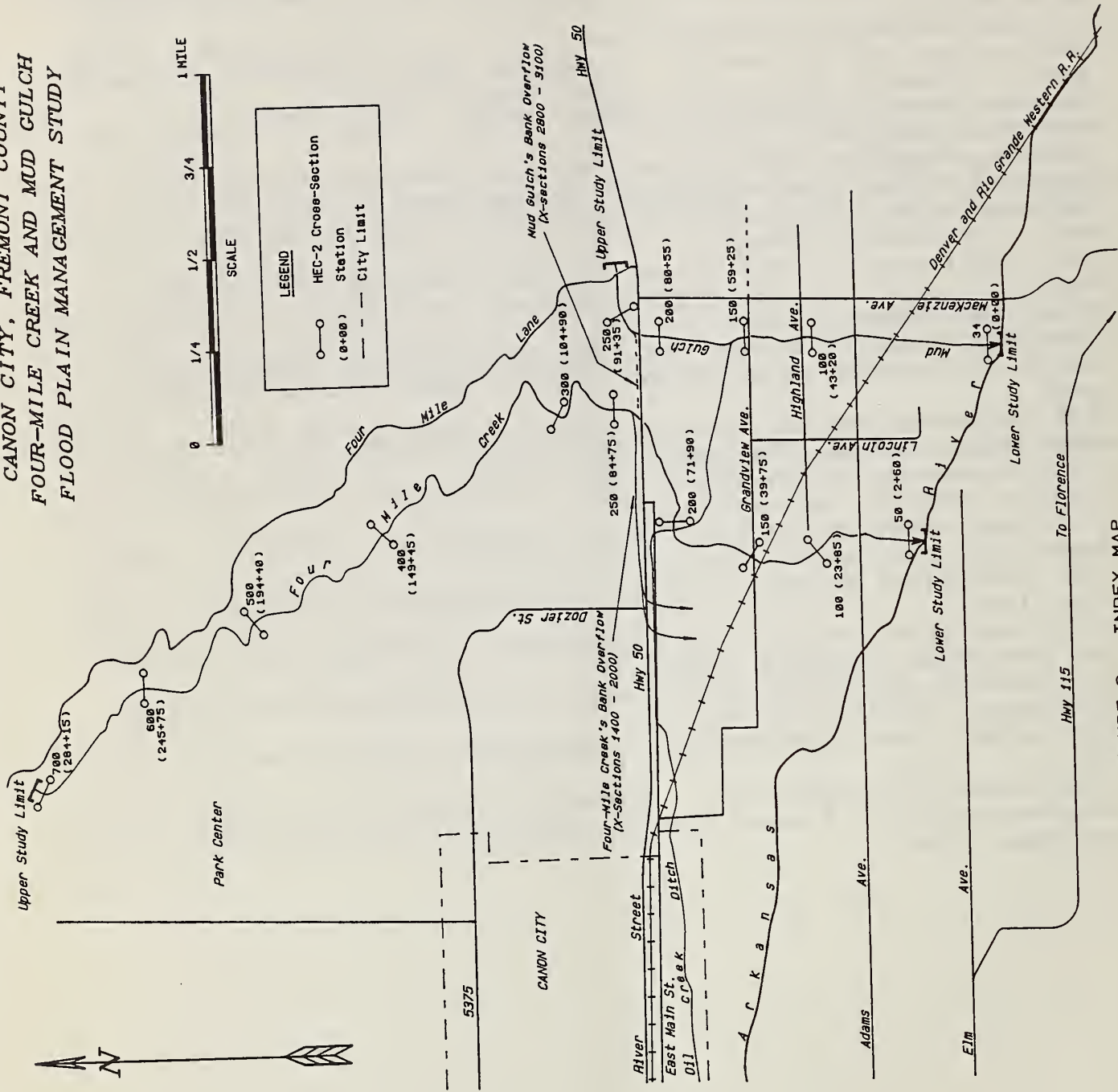


FIGURE 3 - INDEX MAP



TOPOGRAPHY COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY TAKEN APRIL 5, 1979. THE MAPS WERE PREPARED FOR THE CITY OF CANON CITY IN COOPERATION WITH THE COLORADO WATER CONSERVATION BOARD, DENVER, COLORADO.

CROSS SECTION DATA WAS HAND PICKED BY THE W.R.C.S.

THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.

100-YEAR FLOOD BOUNDARY
CITY LIMITS
100-YEAR FLOOD ELEVATION

CROSS SECTION

STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

SCALE IN FEET
MAP CONTOUR INTERVAL = 2 FT

SHEET INDEX

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FLOOD PLAIN MANAGEMENT STUDY
FOUR-MILE CREEK & MUD GULCH
FREMONT COUNTY
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THESE MAPS COMPLY WITH NATIONAL MAP ACCURACY STANDARDS.

100-YEAR FLOOD BOUNDARY

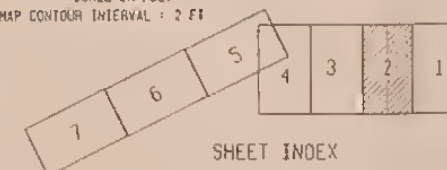
CITY LIMITS

100-YEAR FLOOD ELEVATION

CROSS SECTION

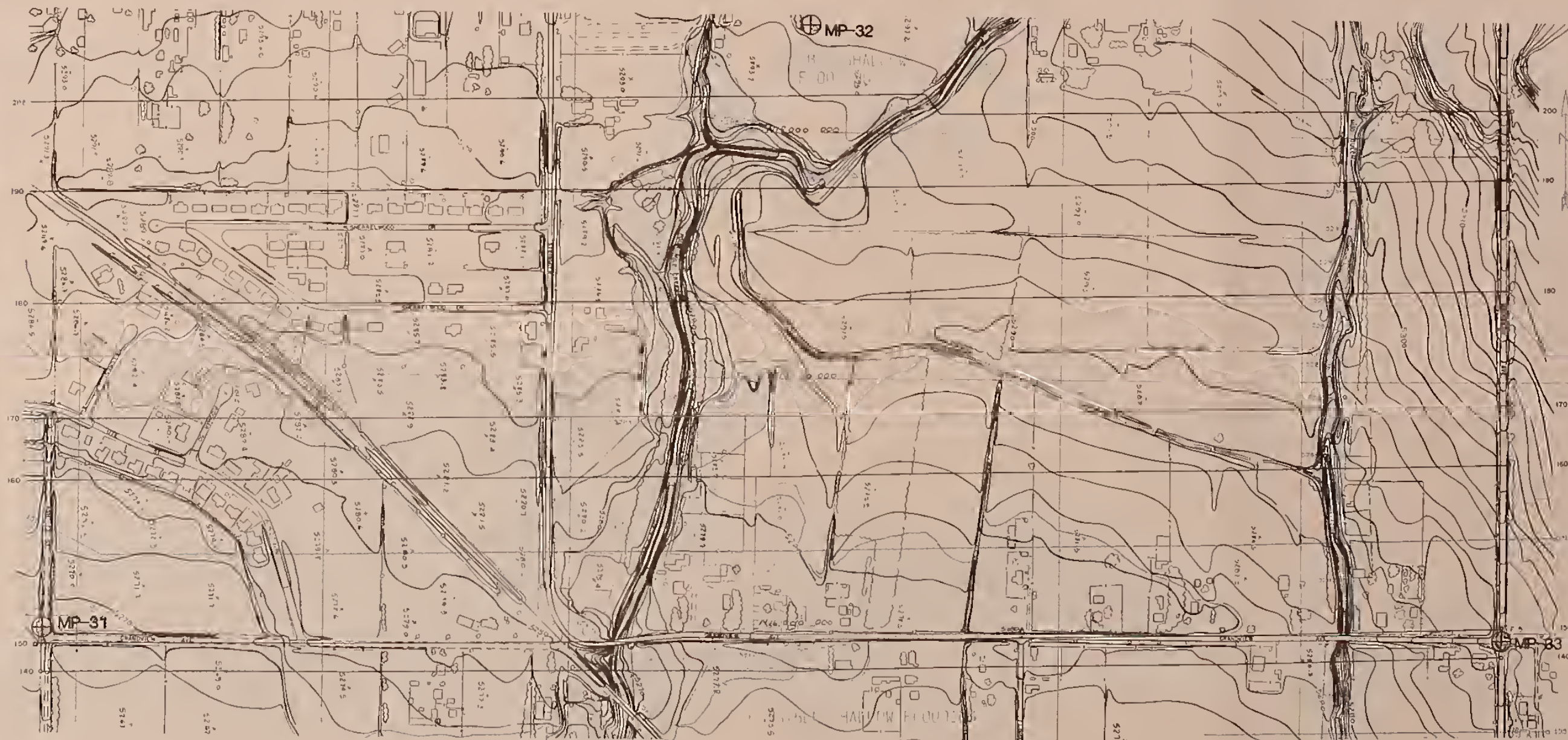
STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

SCALE IN FEET
MAP CONTOUR INTERVAL: 2 FT



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100-YEAR FLOOD BOUNDARY

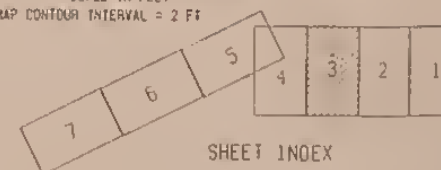
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100-YEAR FLOOD ELEVATION

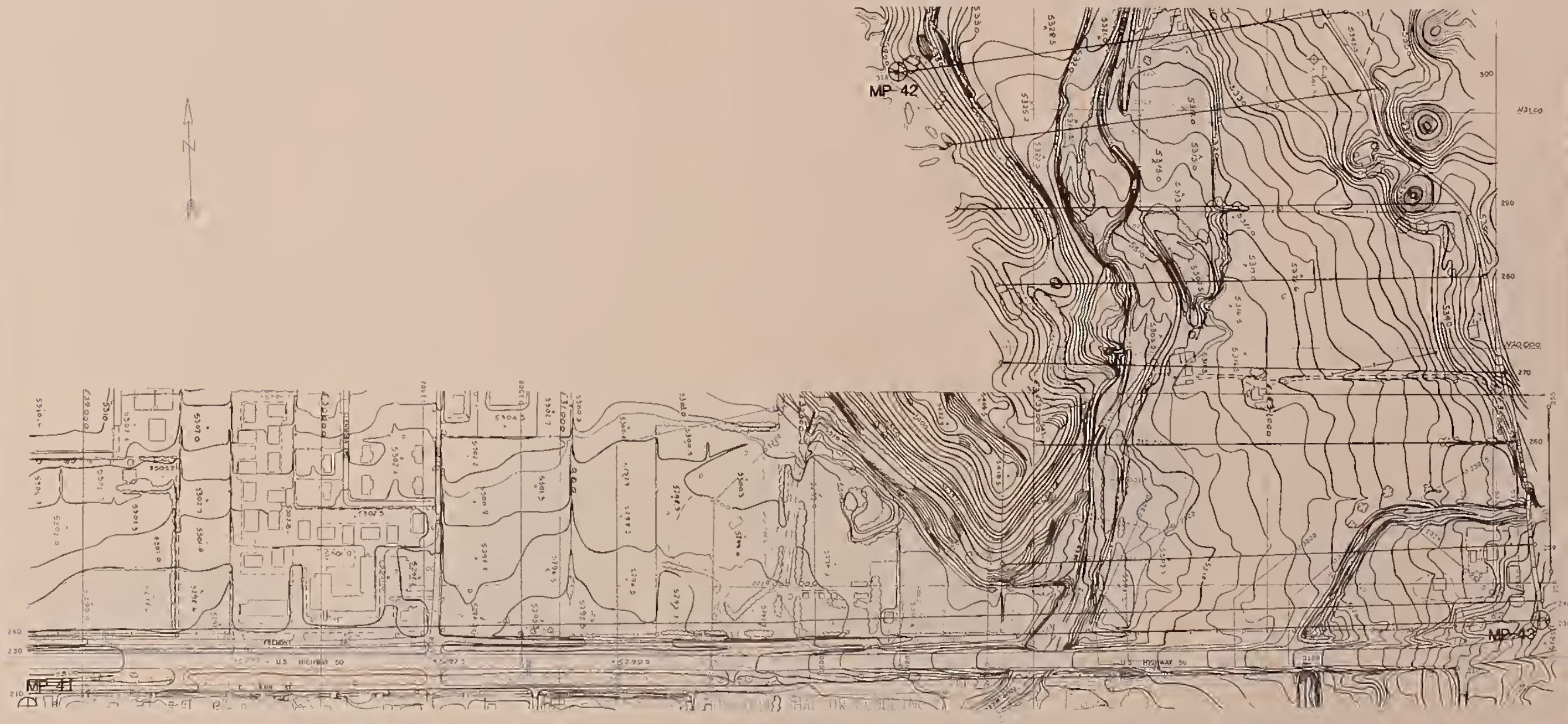
CROSS SECTION

STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

SCALE IN FEET
MAP CONTOUR INTERVAL = 2 FT



FLOOD PLAINS
FLOOD PLAIN MANAGEMENT STUDY
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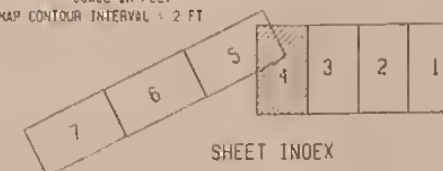
----- CITY LIMITS

~~~~~ 5330 100-YEAR FLOOD ELEVATION

----- CROSS SECTION

----- STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

SCALE IN FEET  
MAP CONTOUR INTERVAL - 2 FT

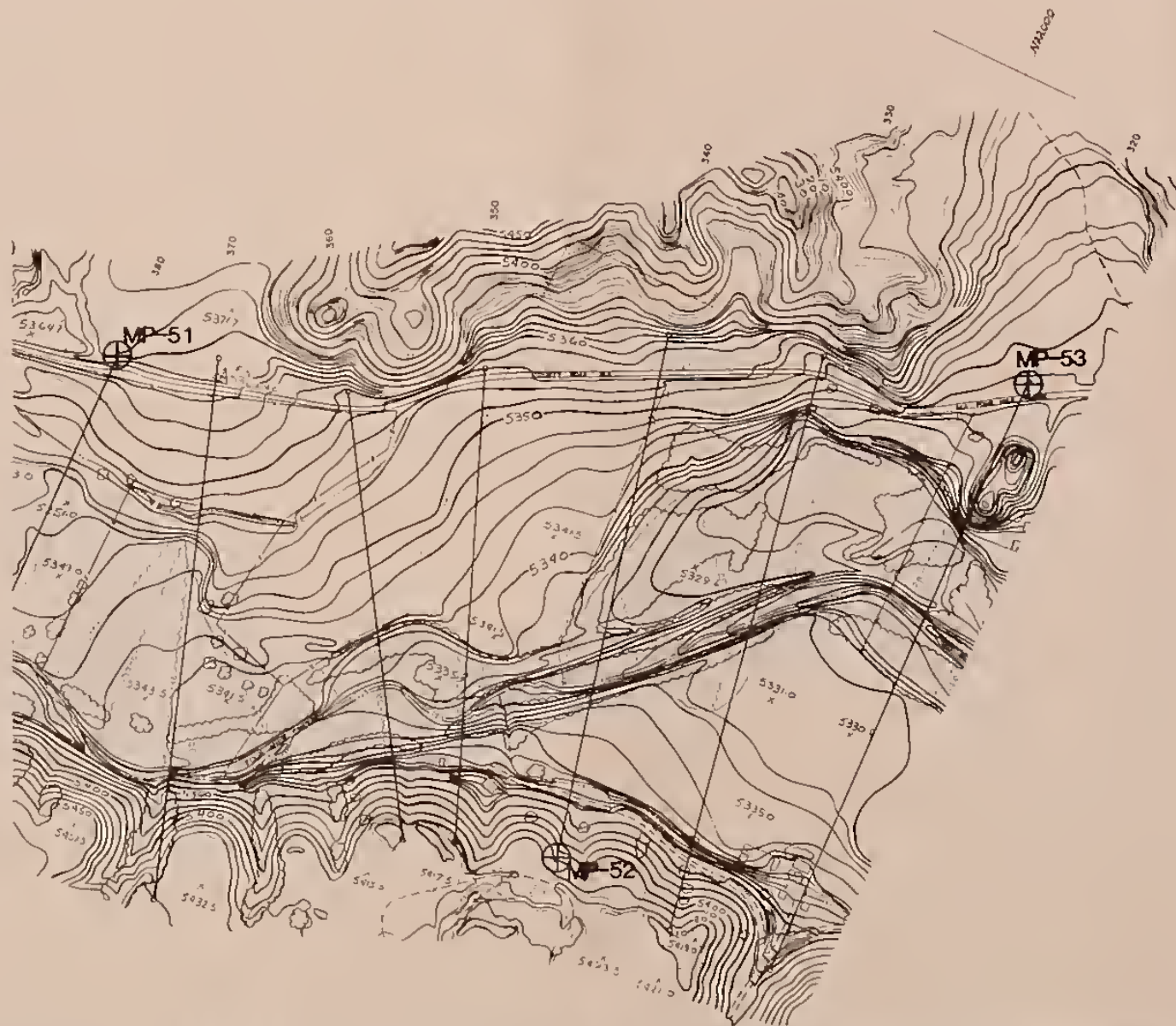


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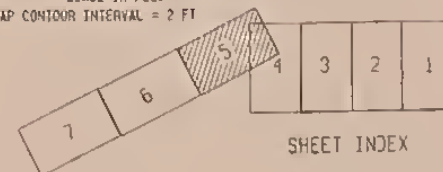
CITY LIMITS

100-YEAR FLOOD ELEVATION

CROSS SECTION

STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

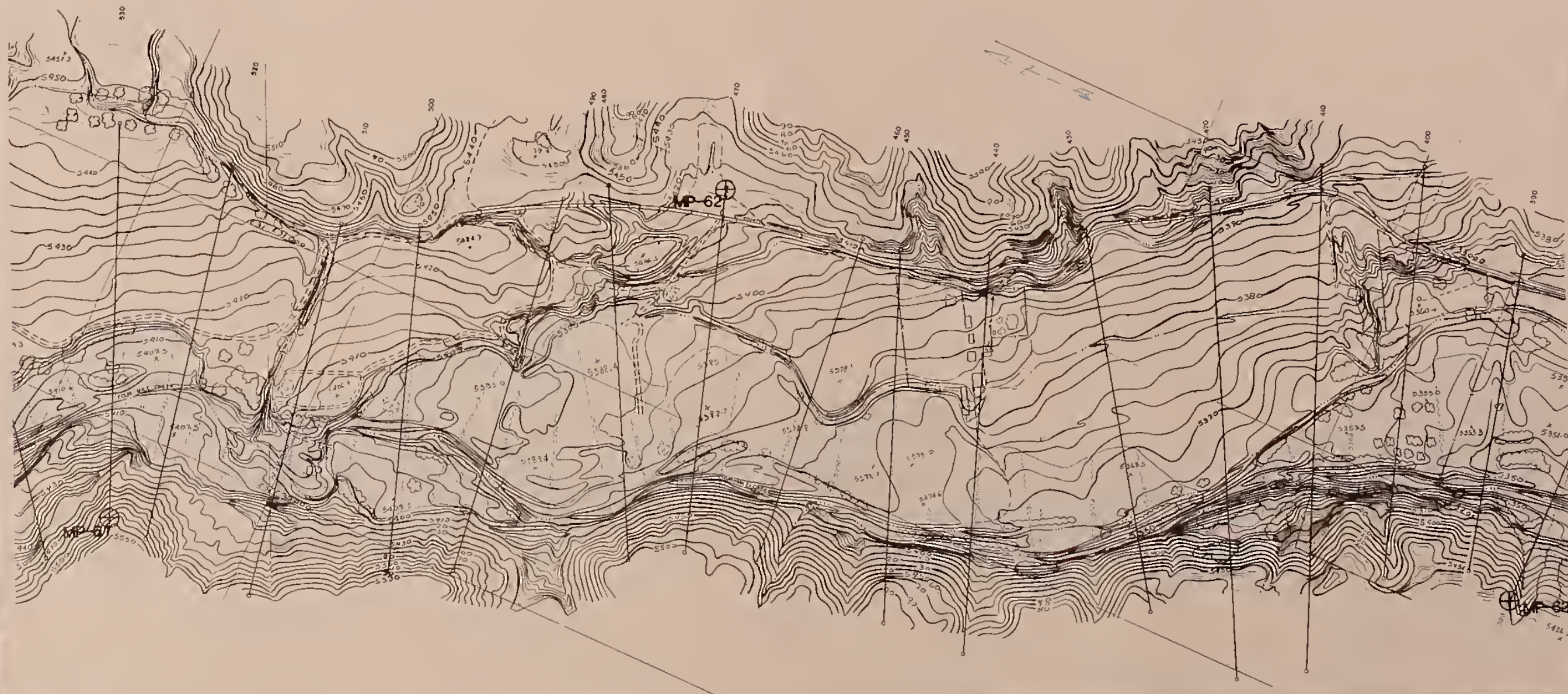
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FLOOD PLAINS  
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100-YEAR FLOOD BOUNDARY

CITY LIMITS

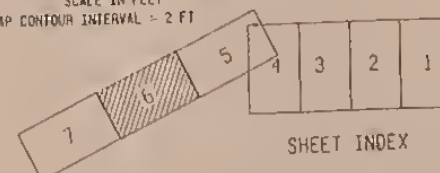
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CROSS SECTION

100

STREAM CENTERLINE AND STATION IN 100 FT FROM LOWER STUDY LIMIT

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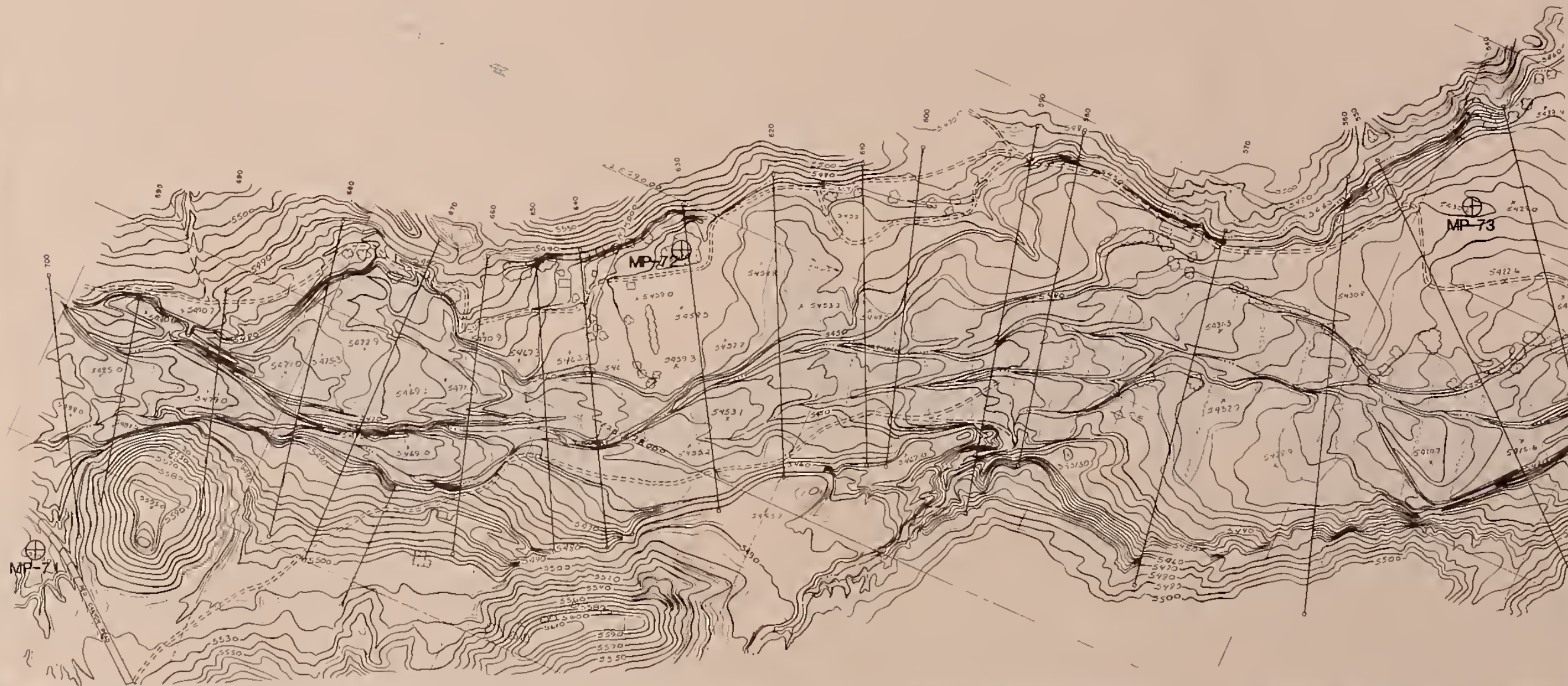


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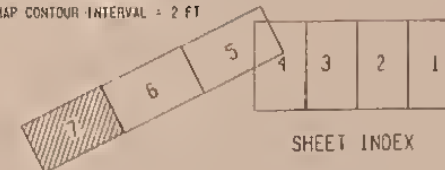
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100-YEAR FLOOD ELEVATION

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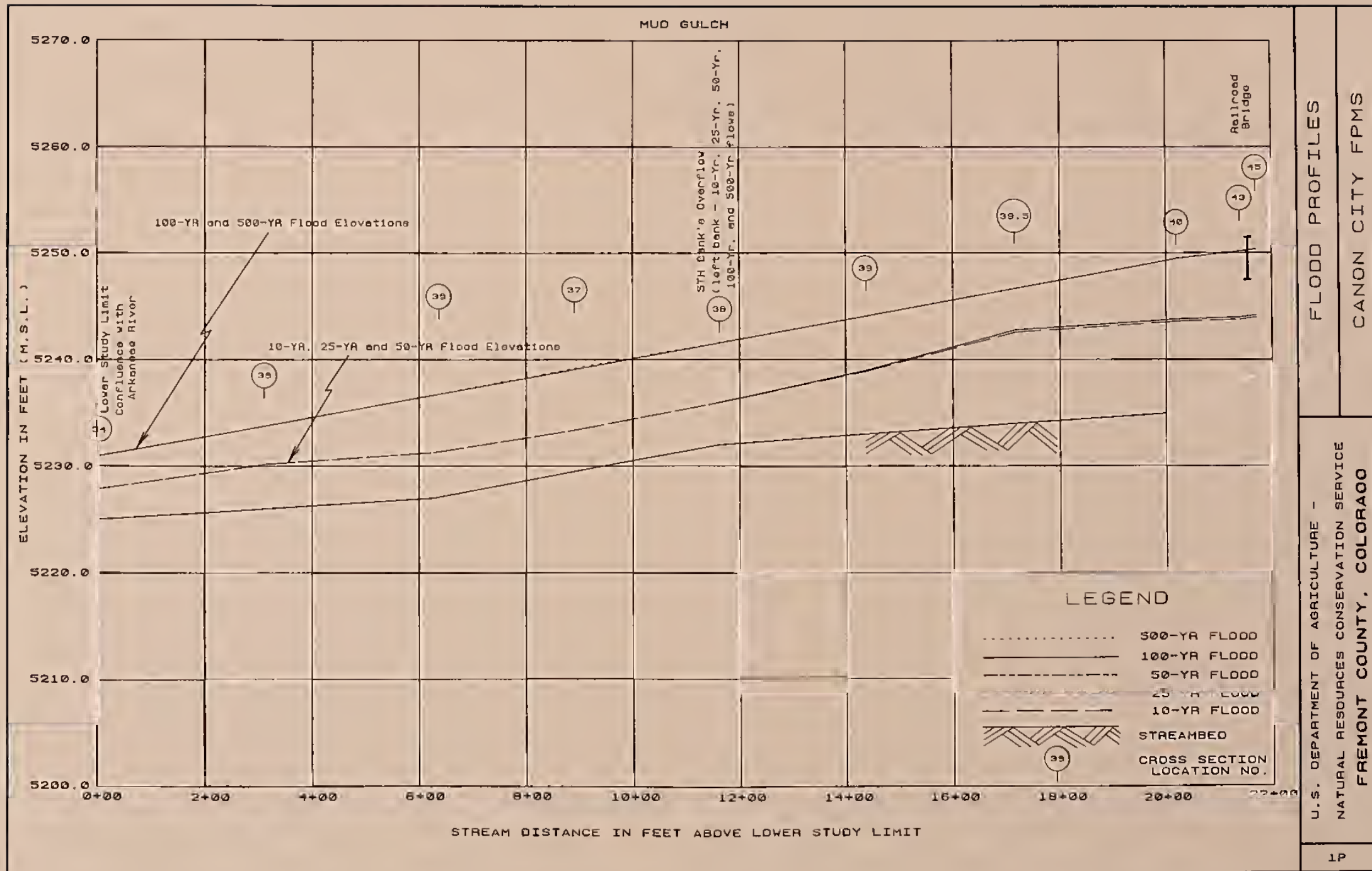


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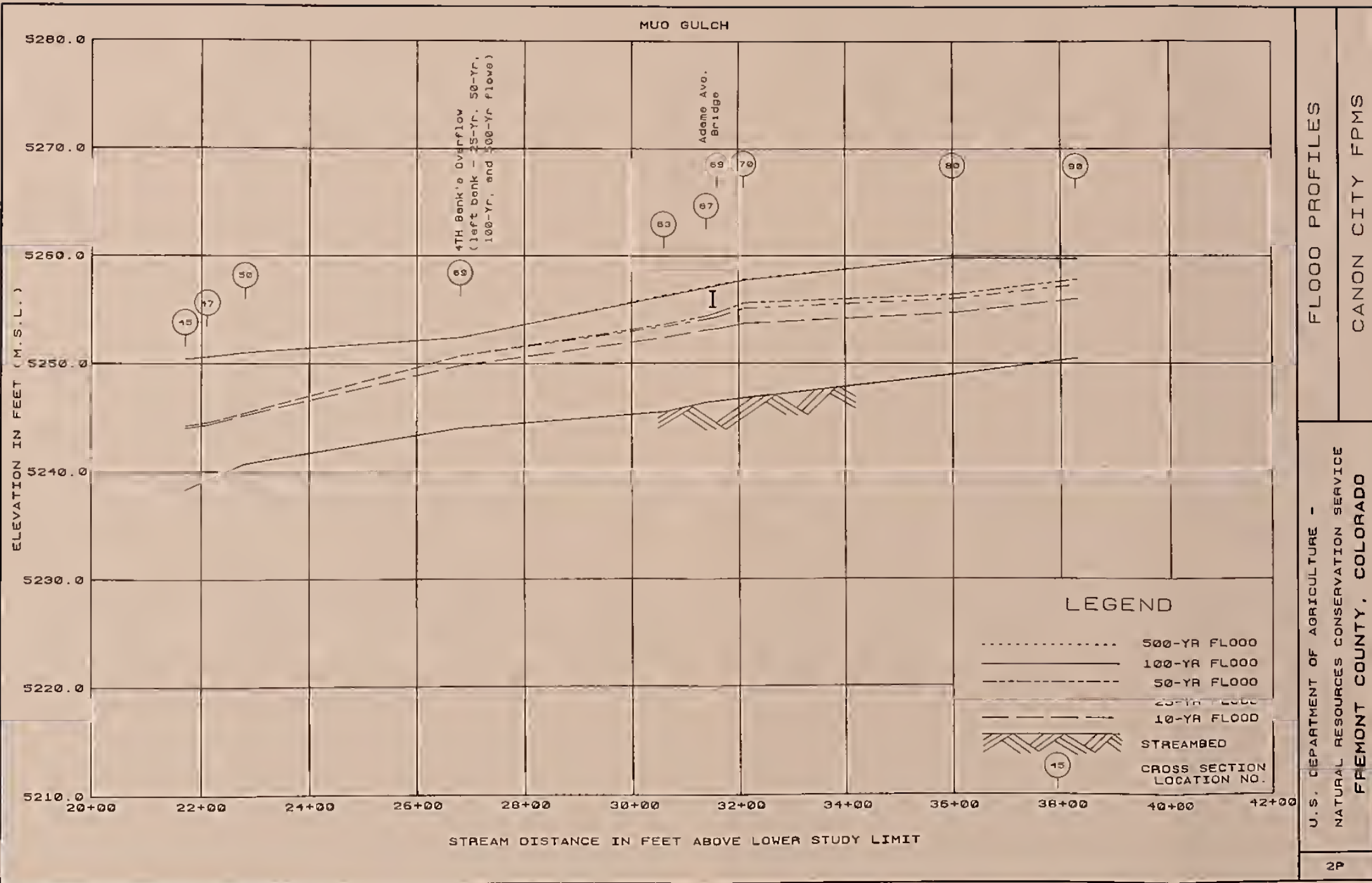


FLOOD PROFILES

CANON CITY FPMS

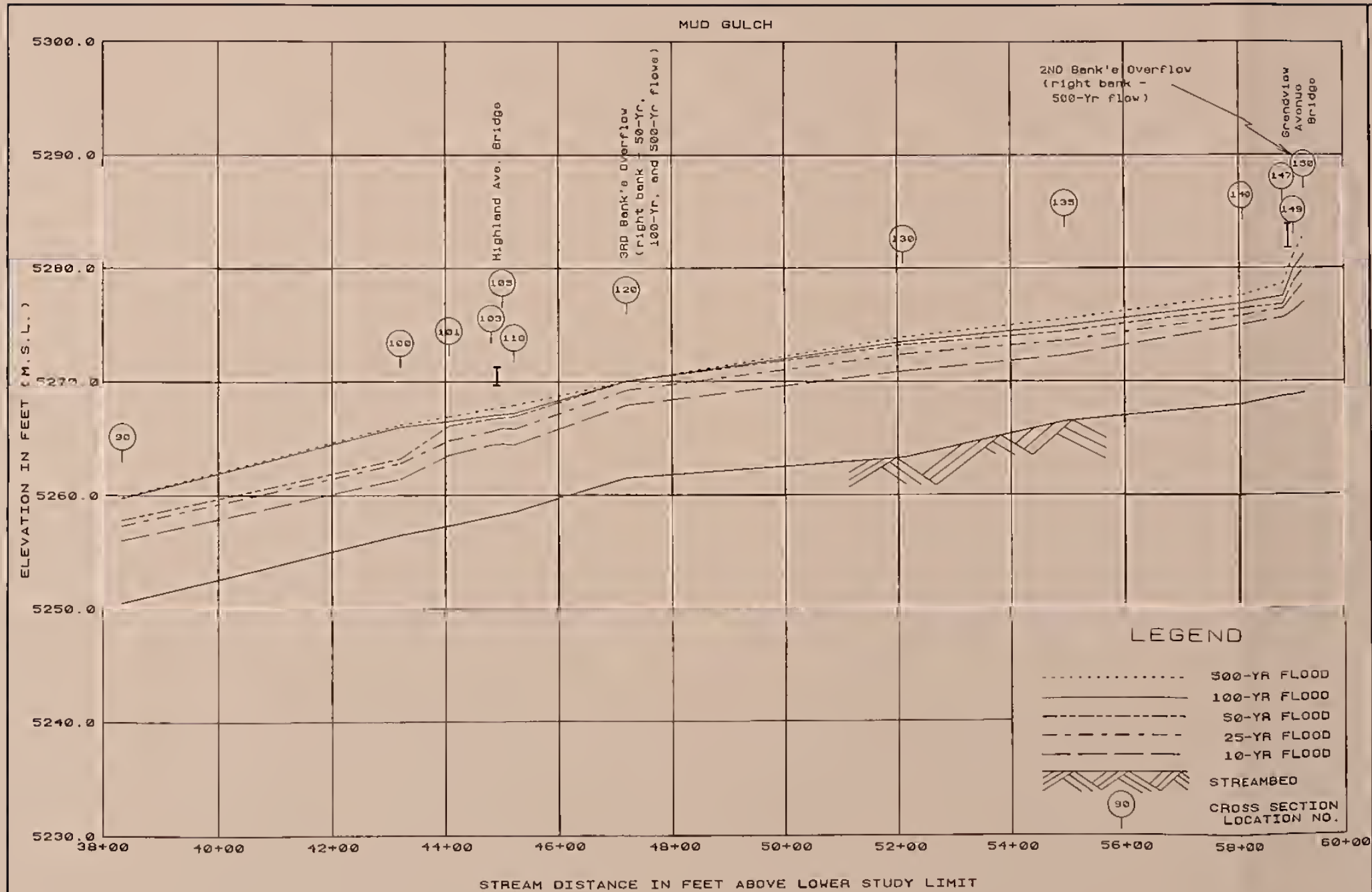
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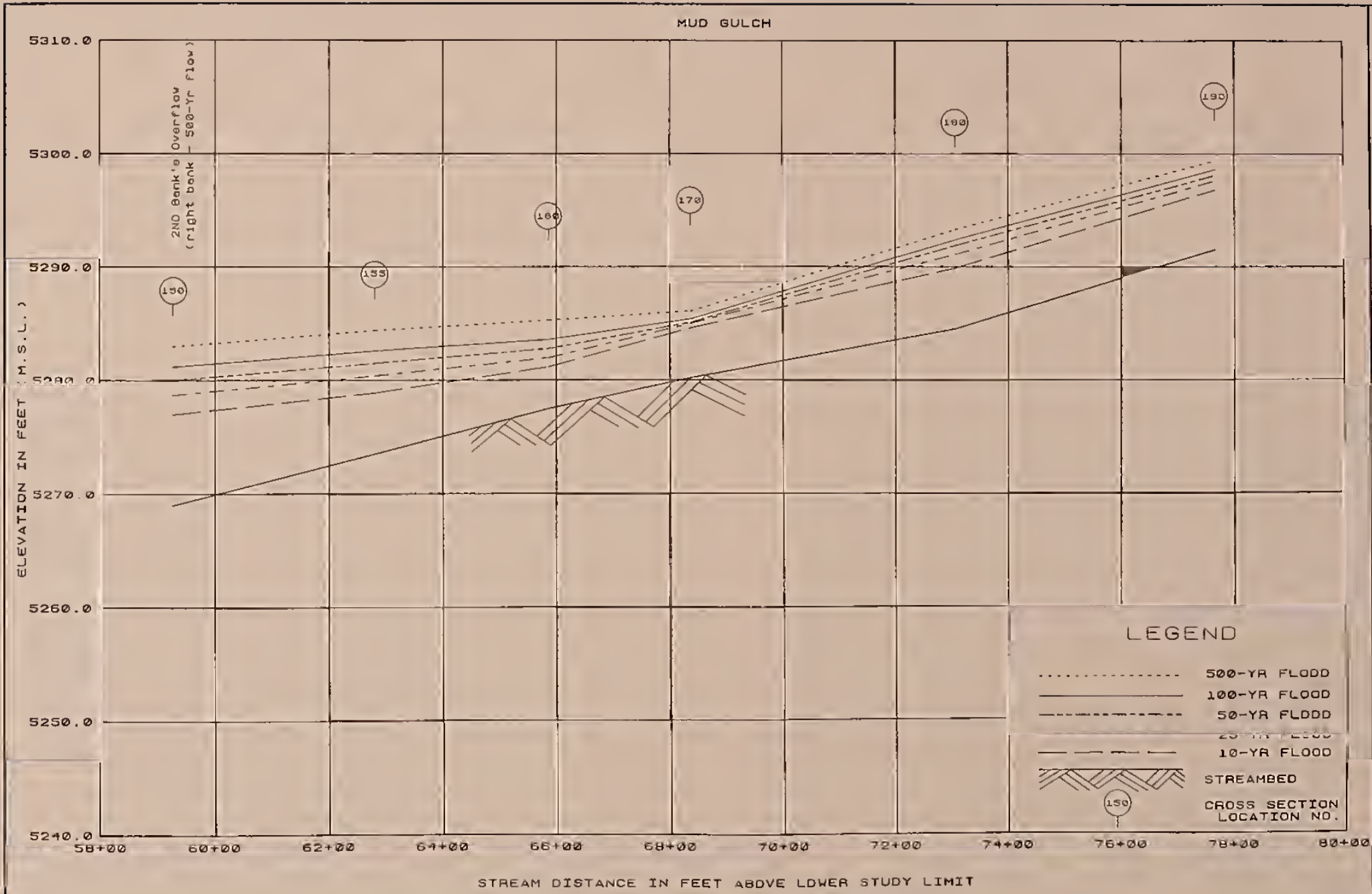


FLOOD PROFILES

CANON CITY FPMs

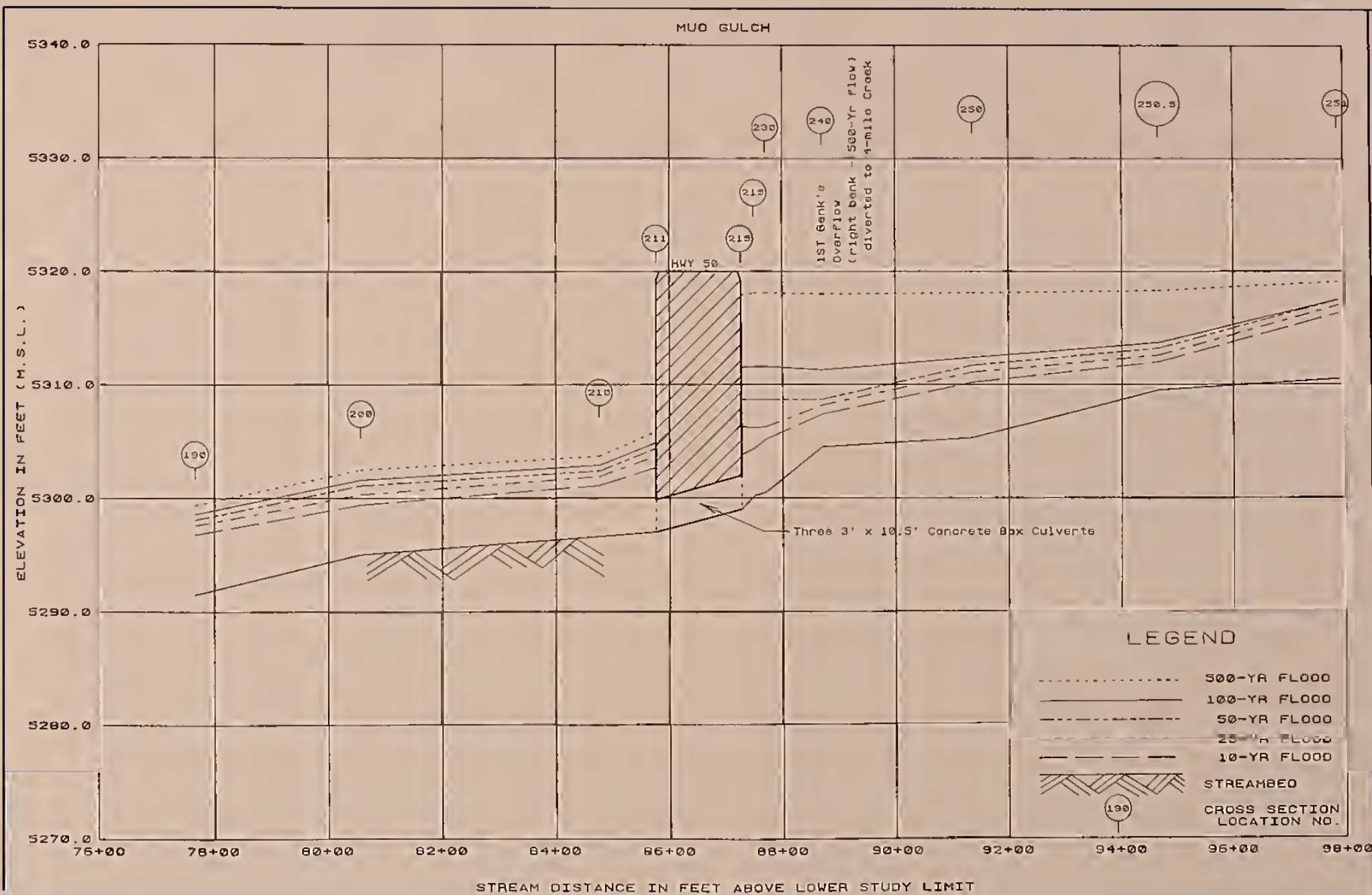
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FLOOD PROFILES

CANON CITY FPMS

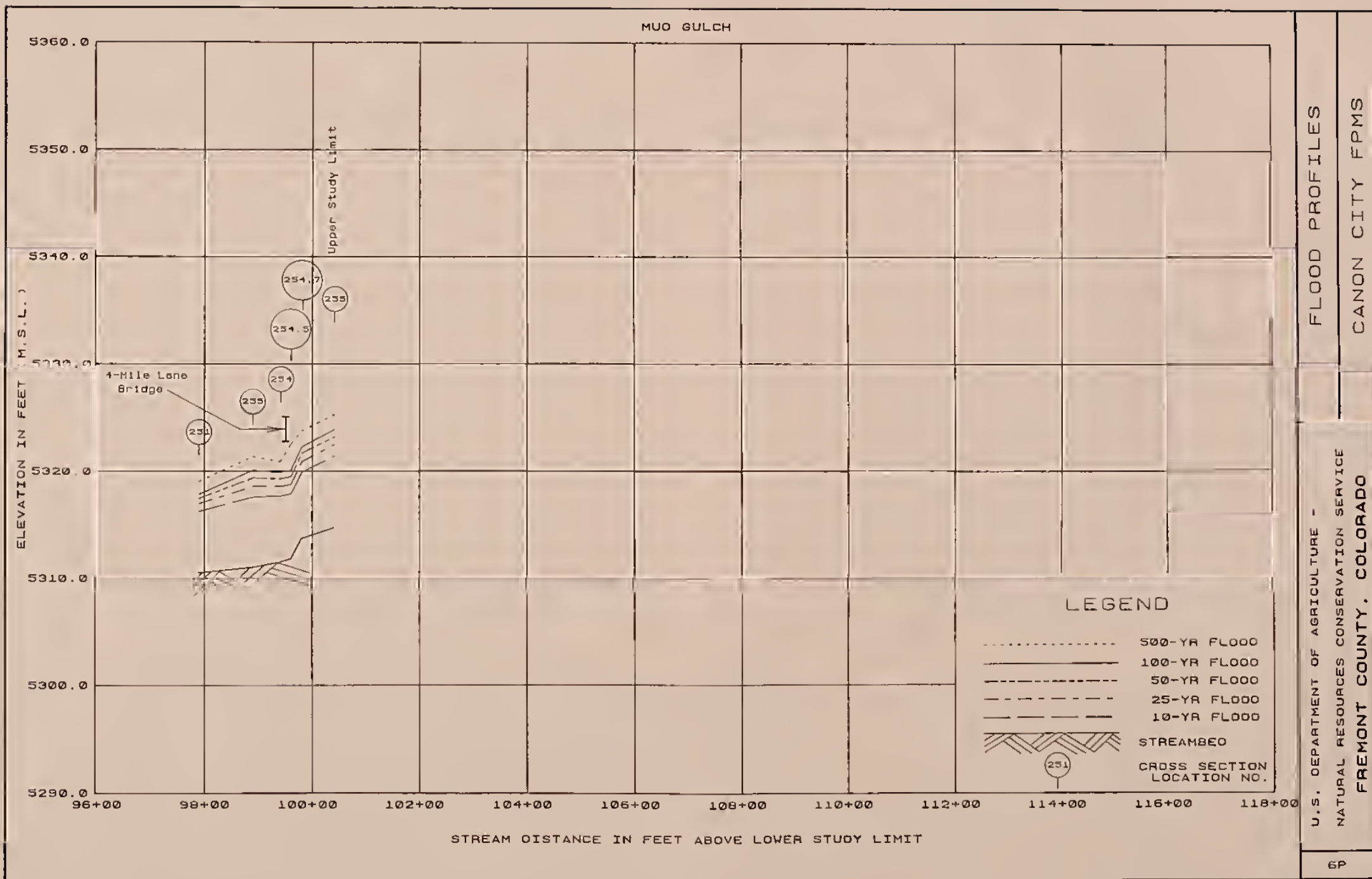
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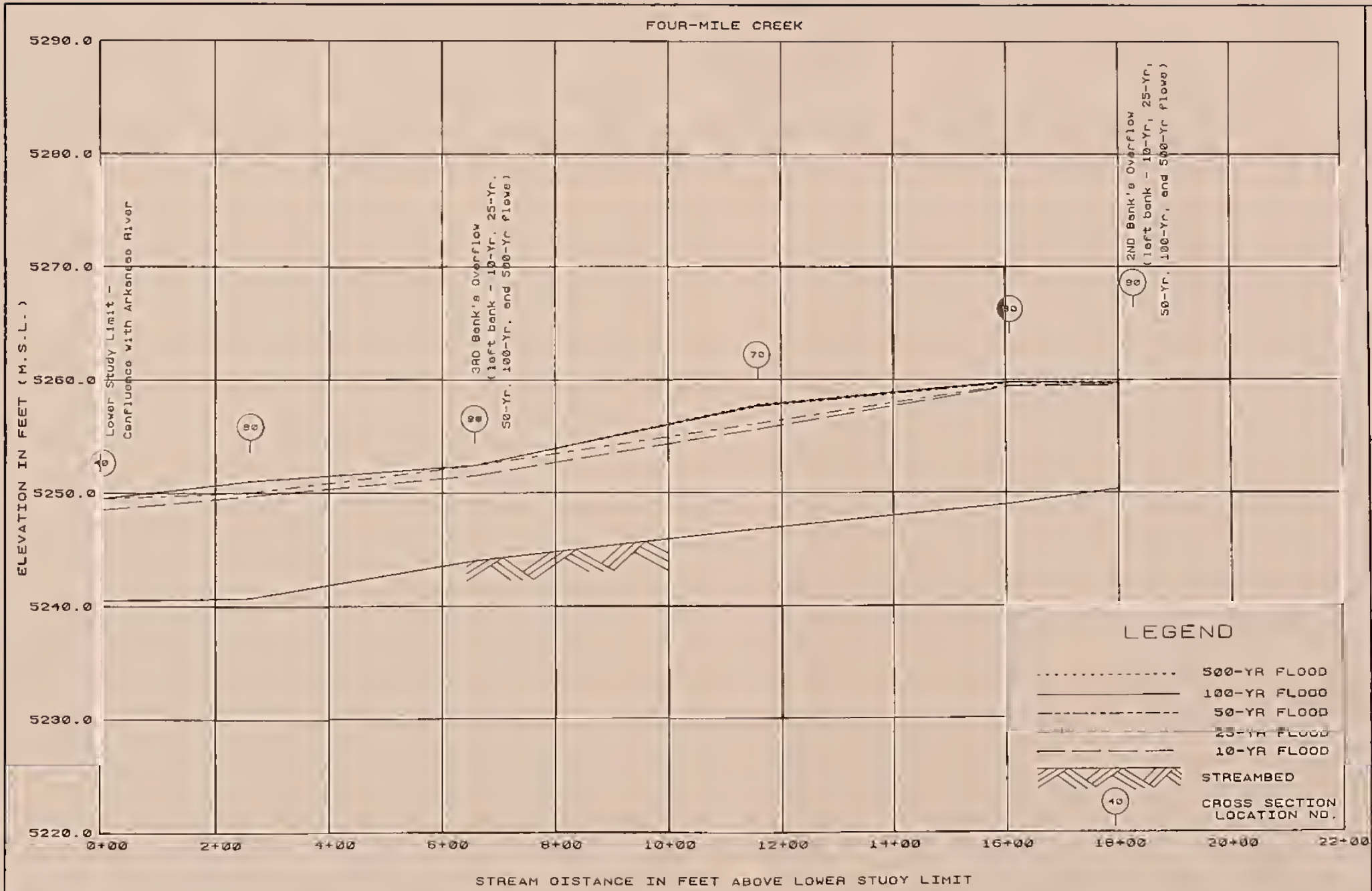
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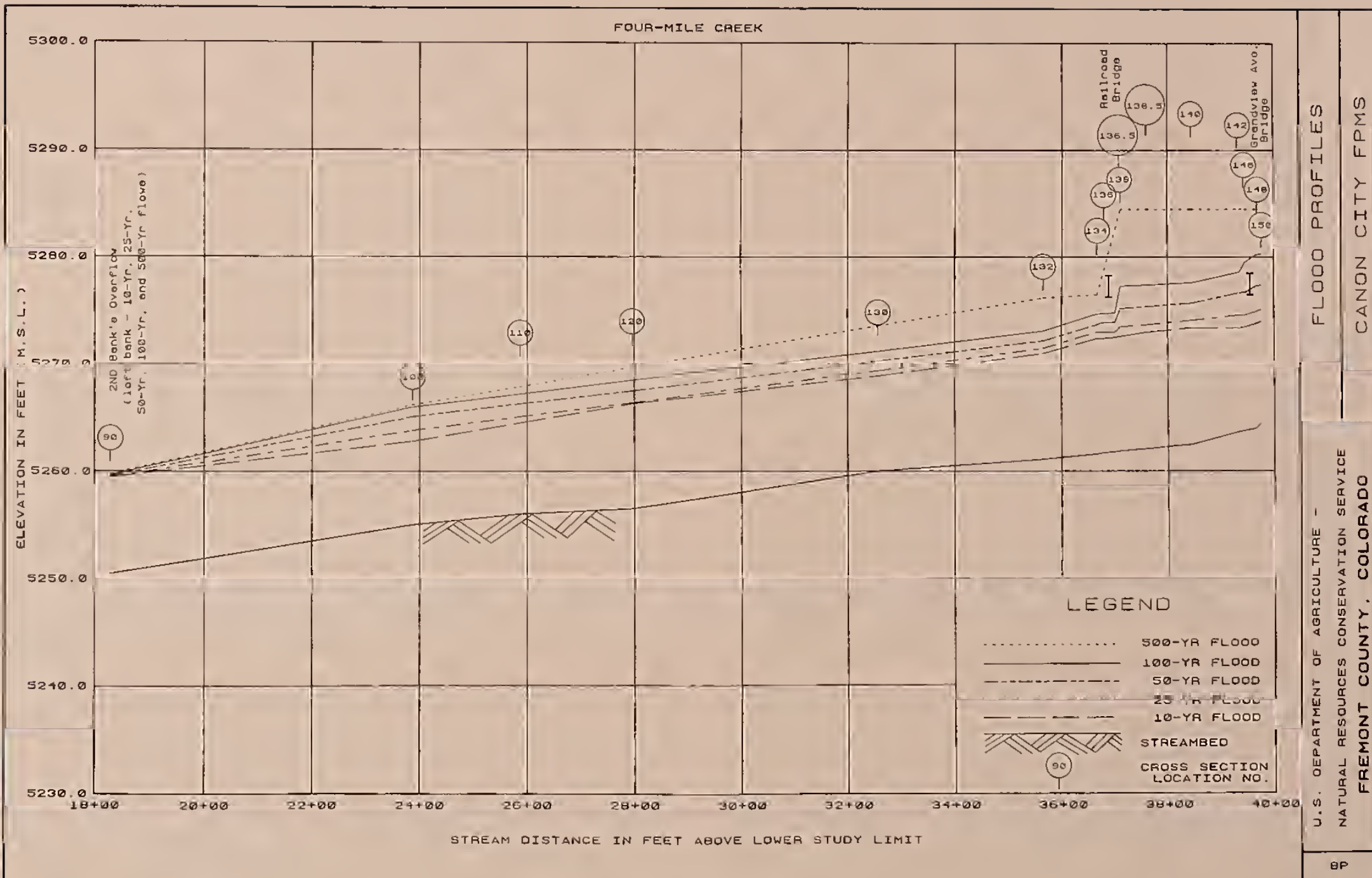
















# FOUR-MILE CREEK

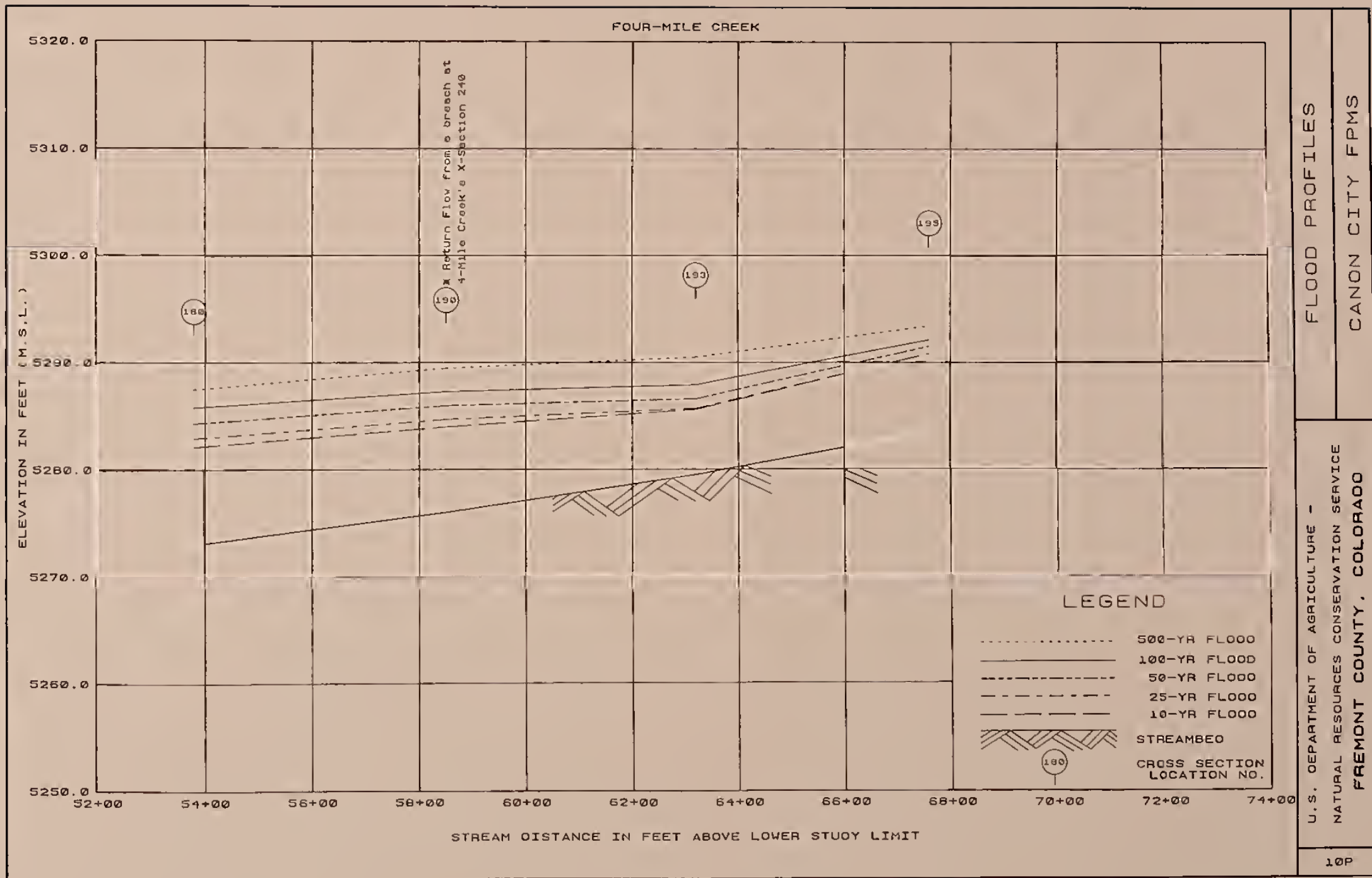


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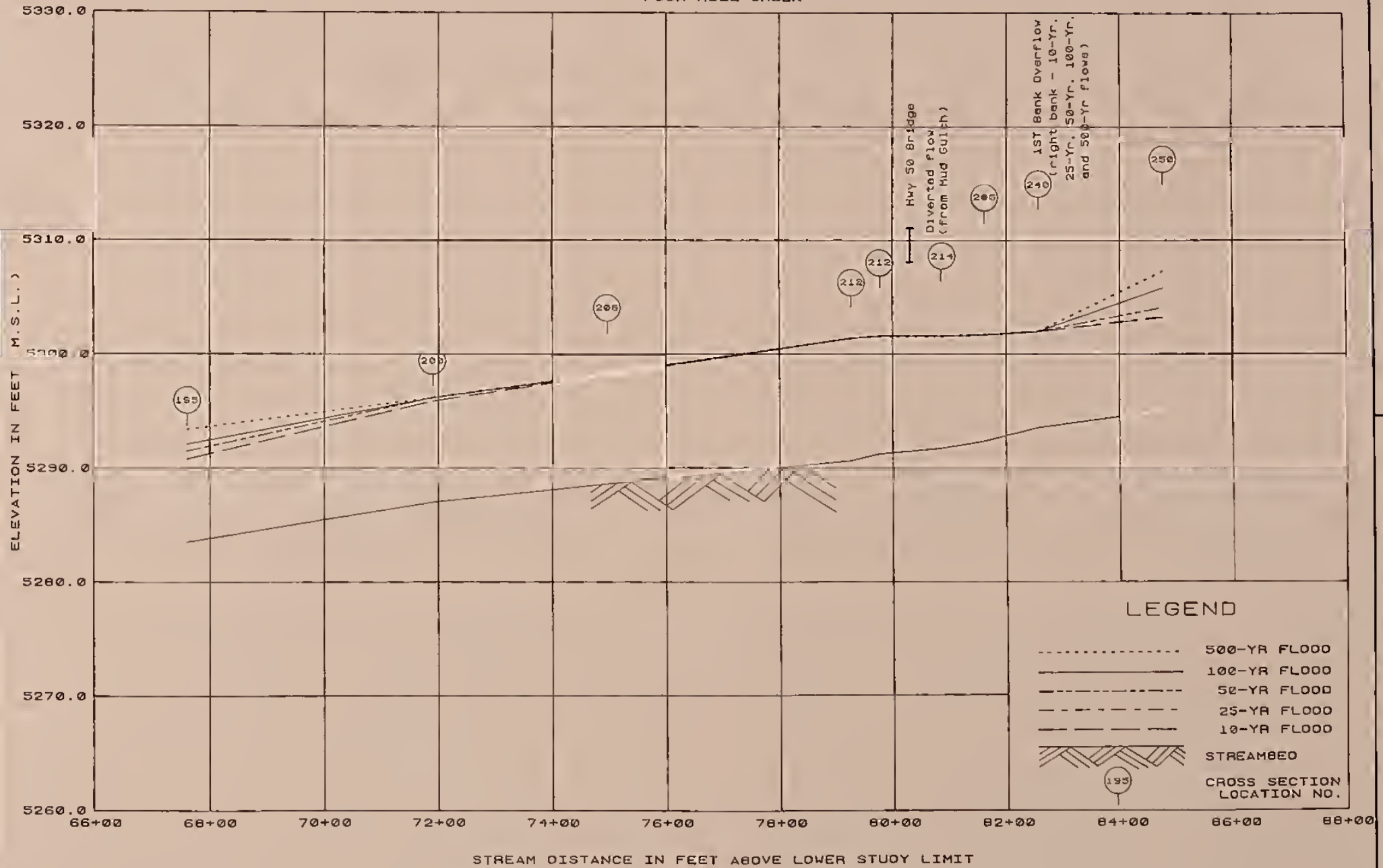








# FOUR-MILE CREEK



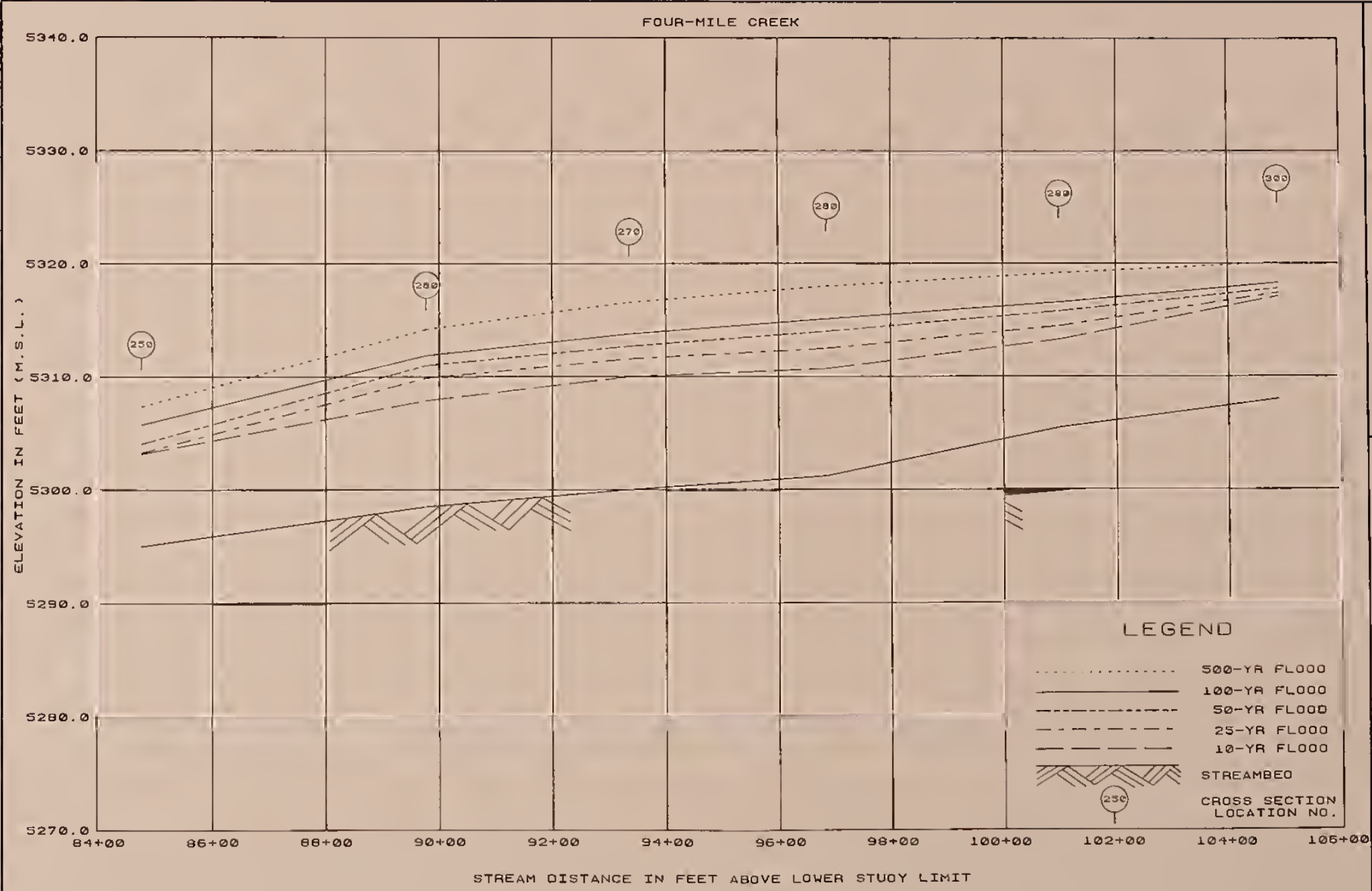
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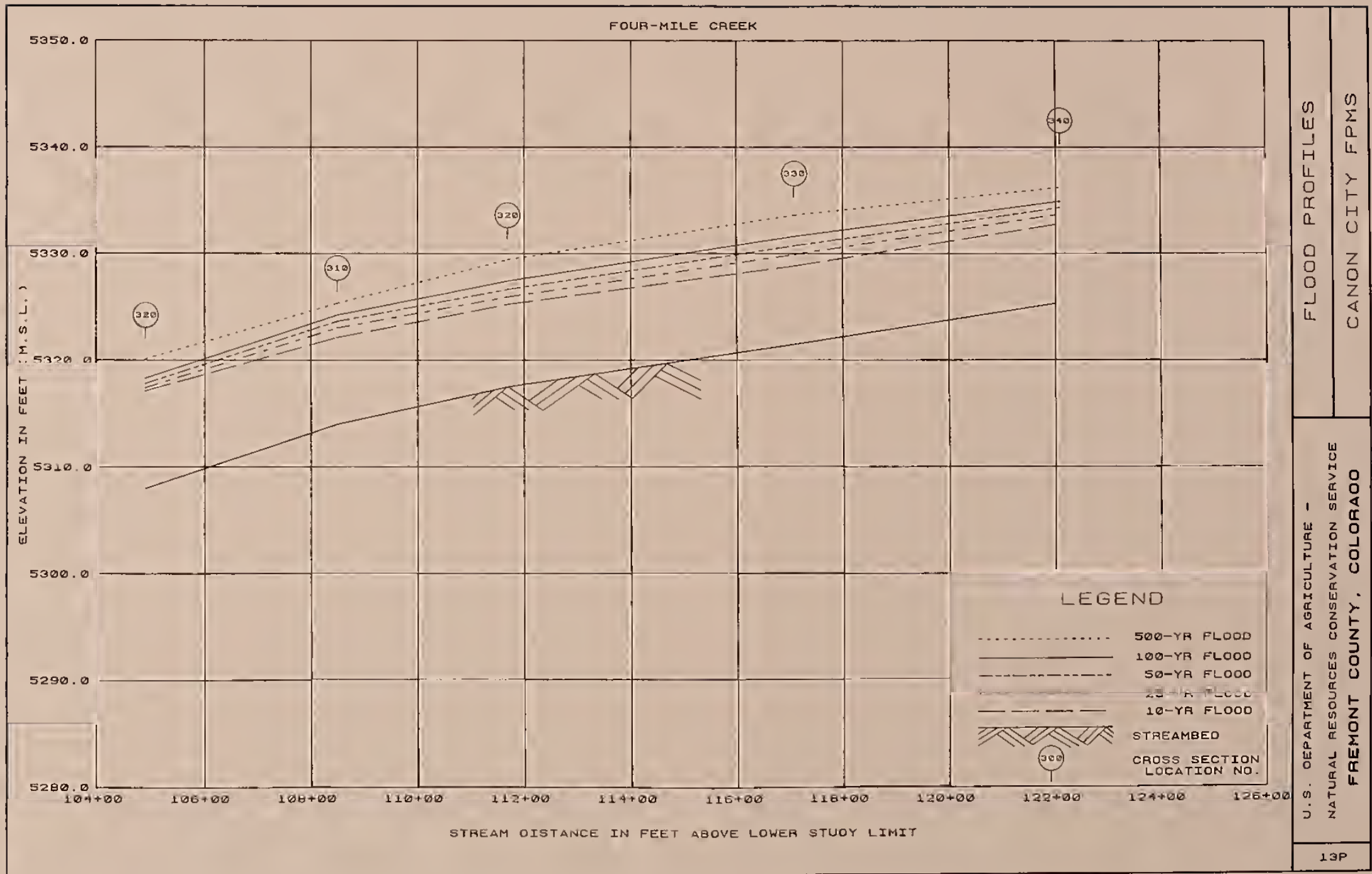


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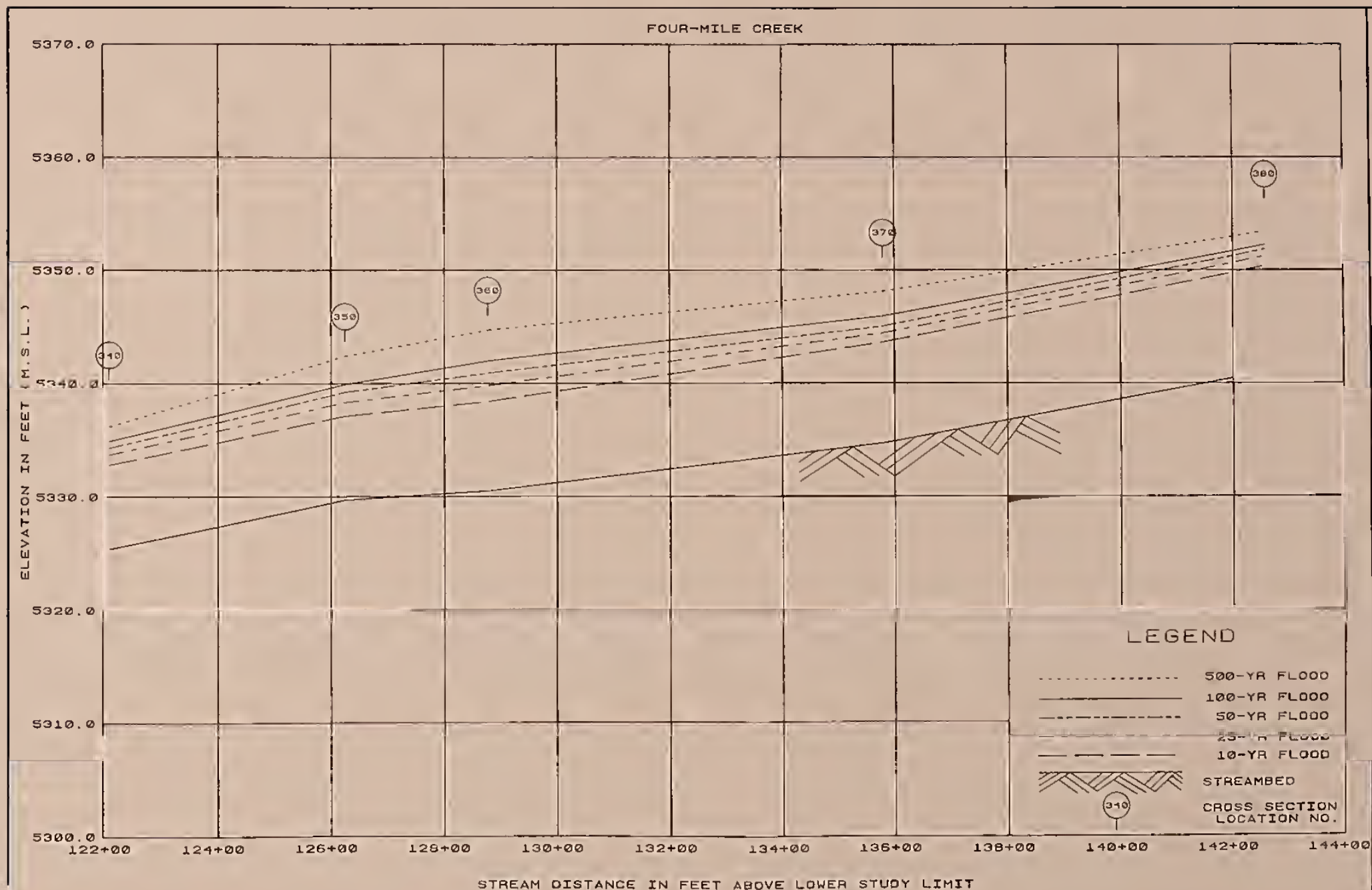
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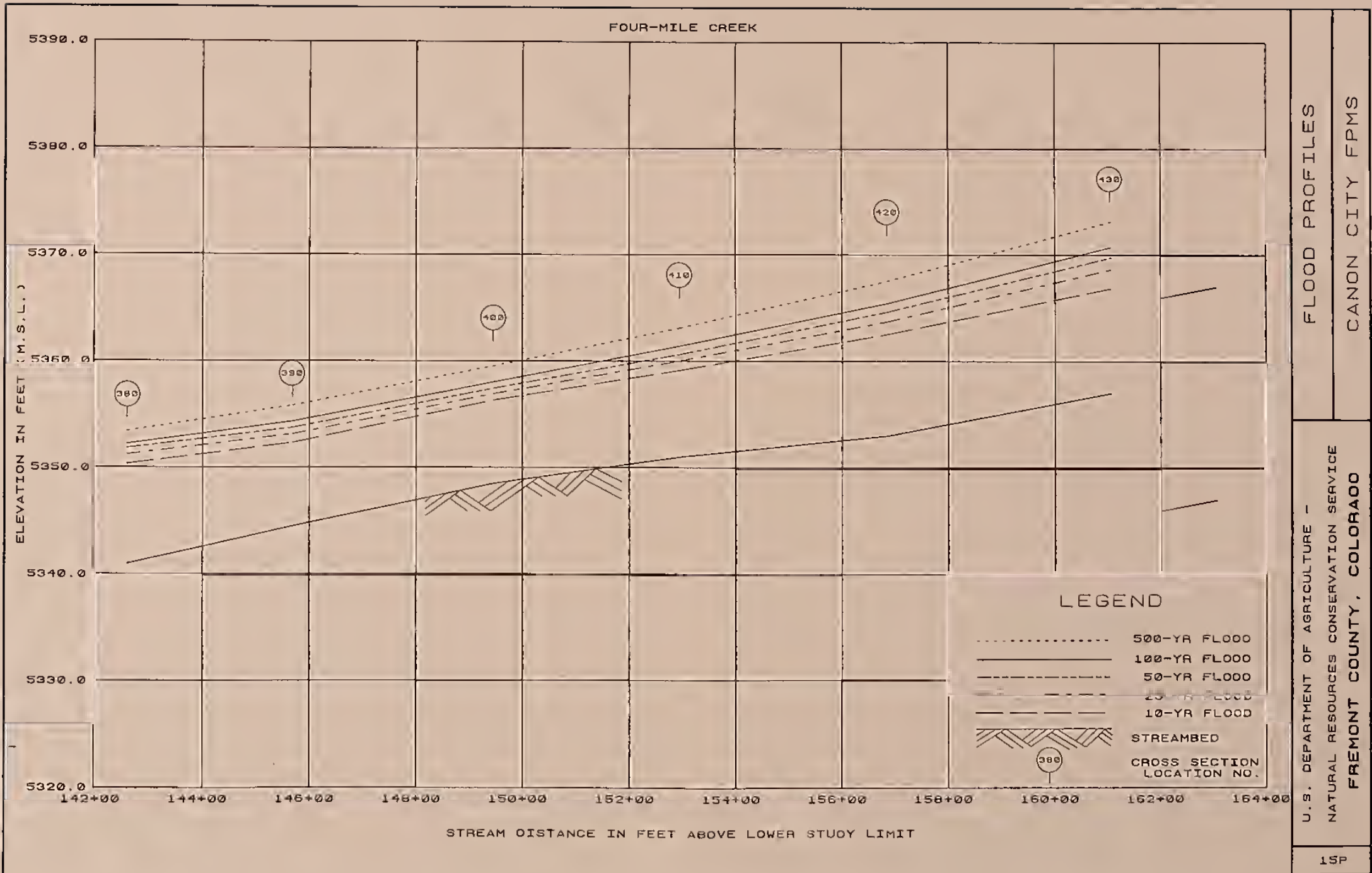
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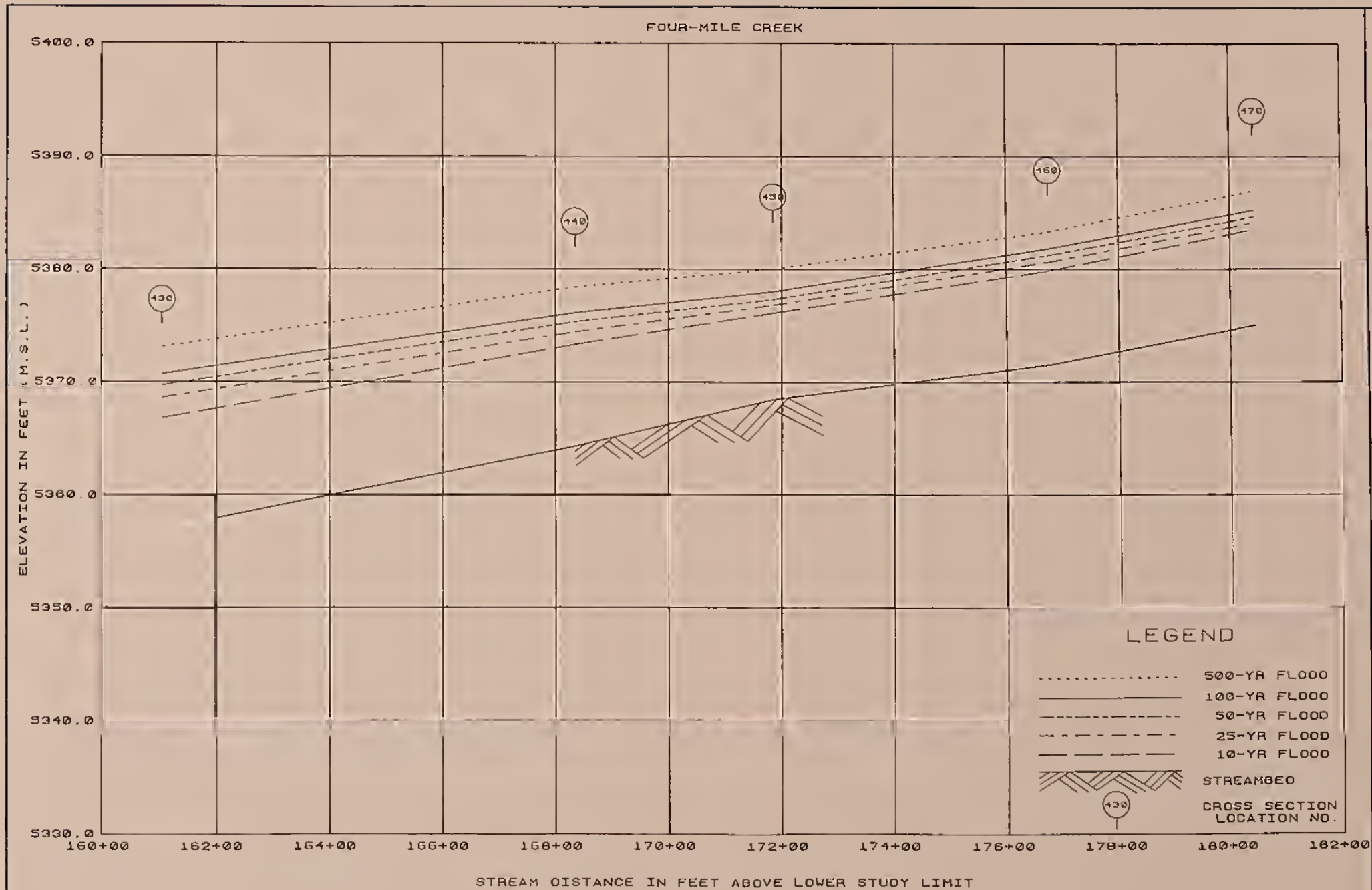
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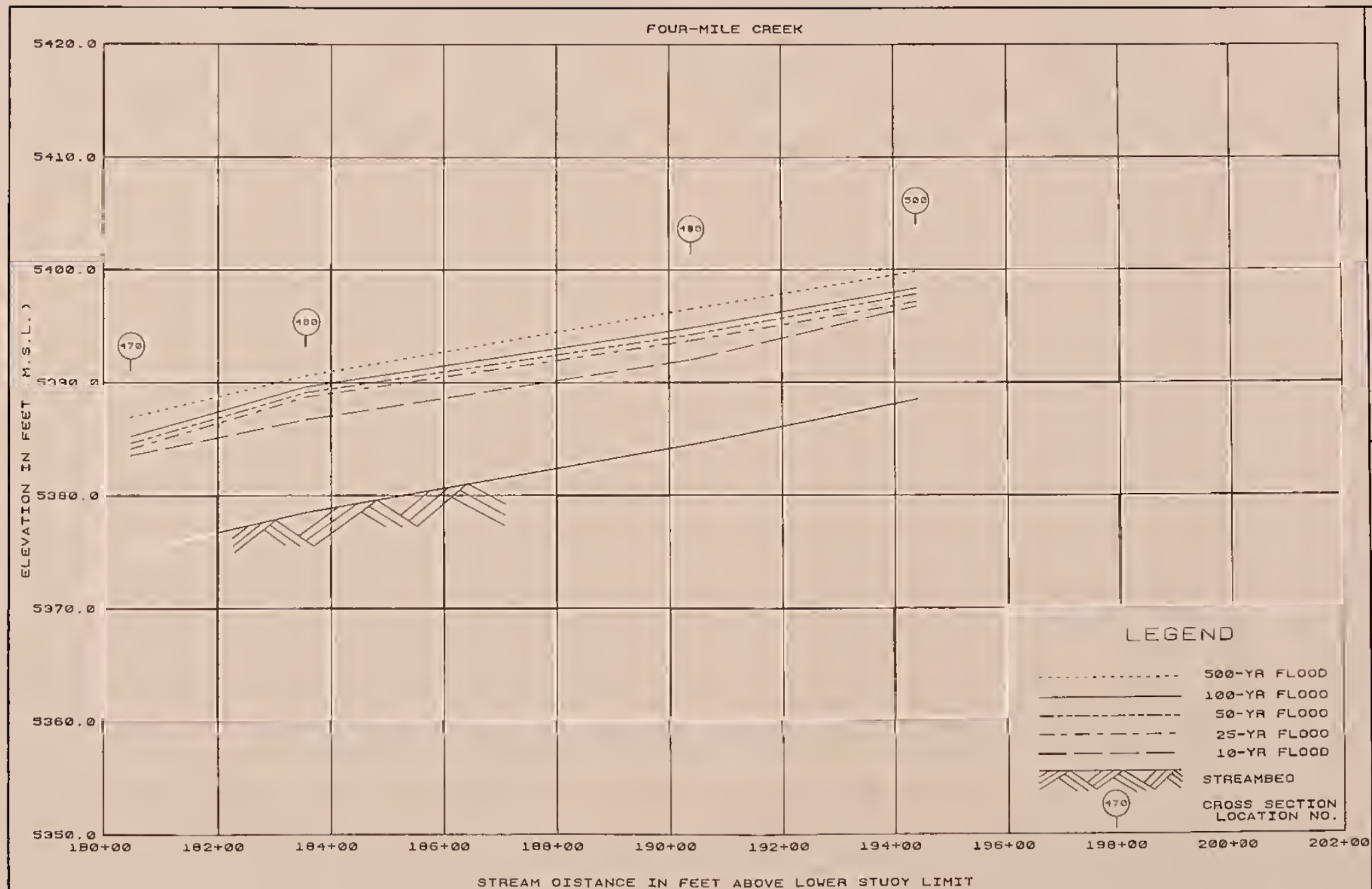
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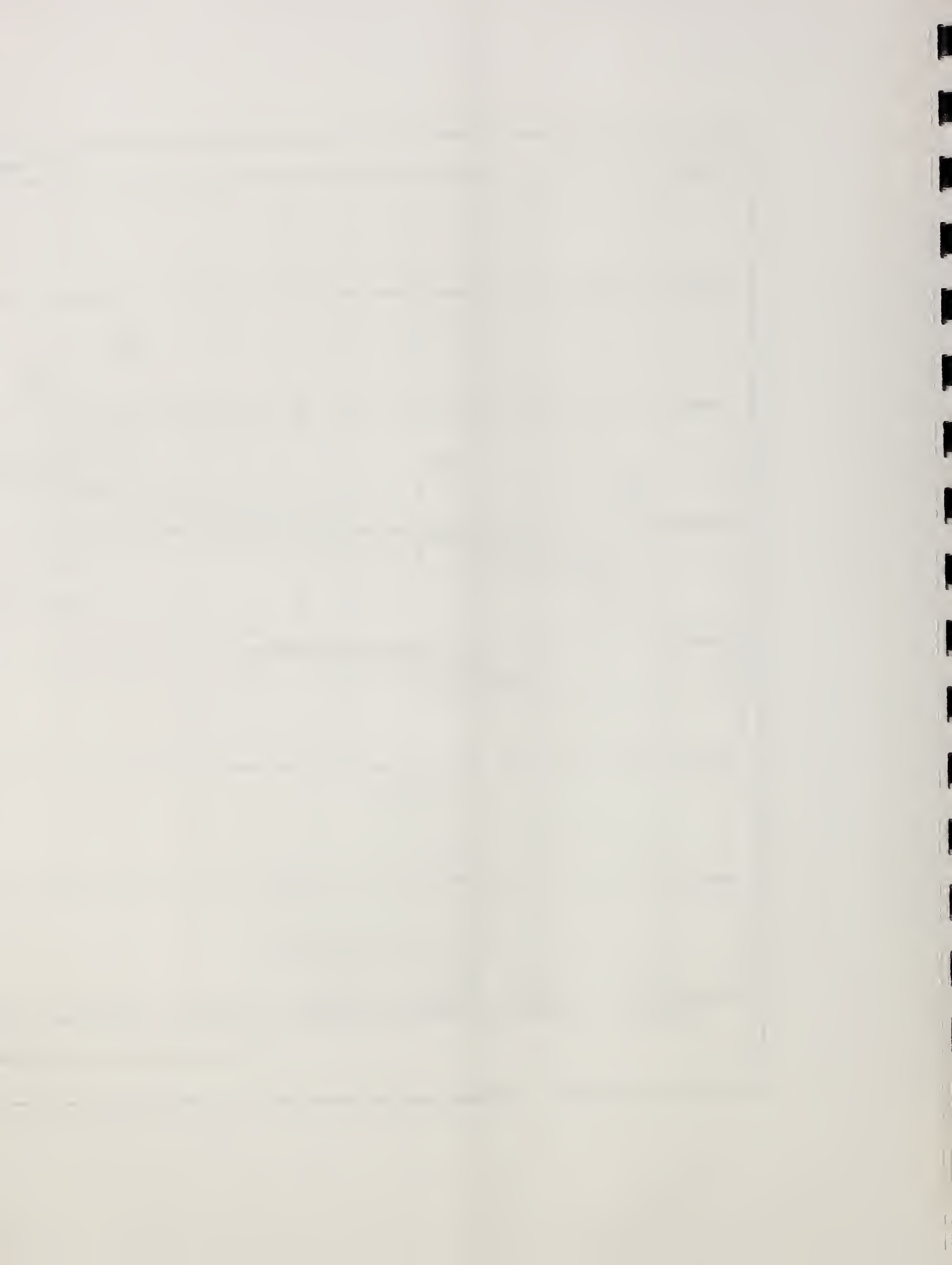
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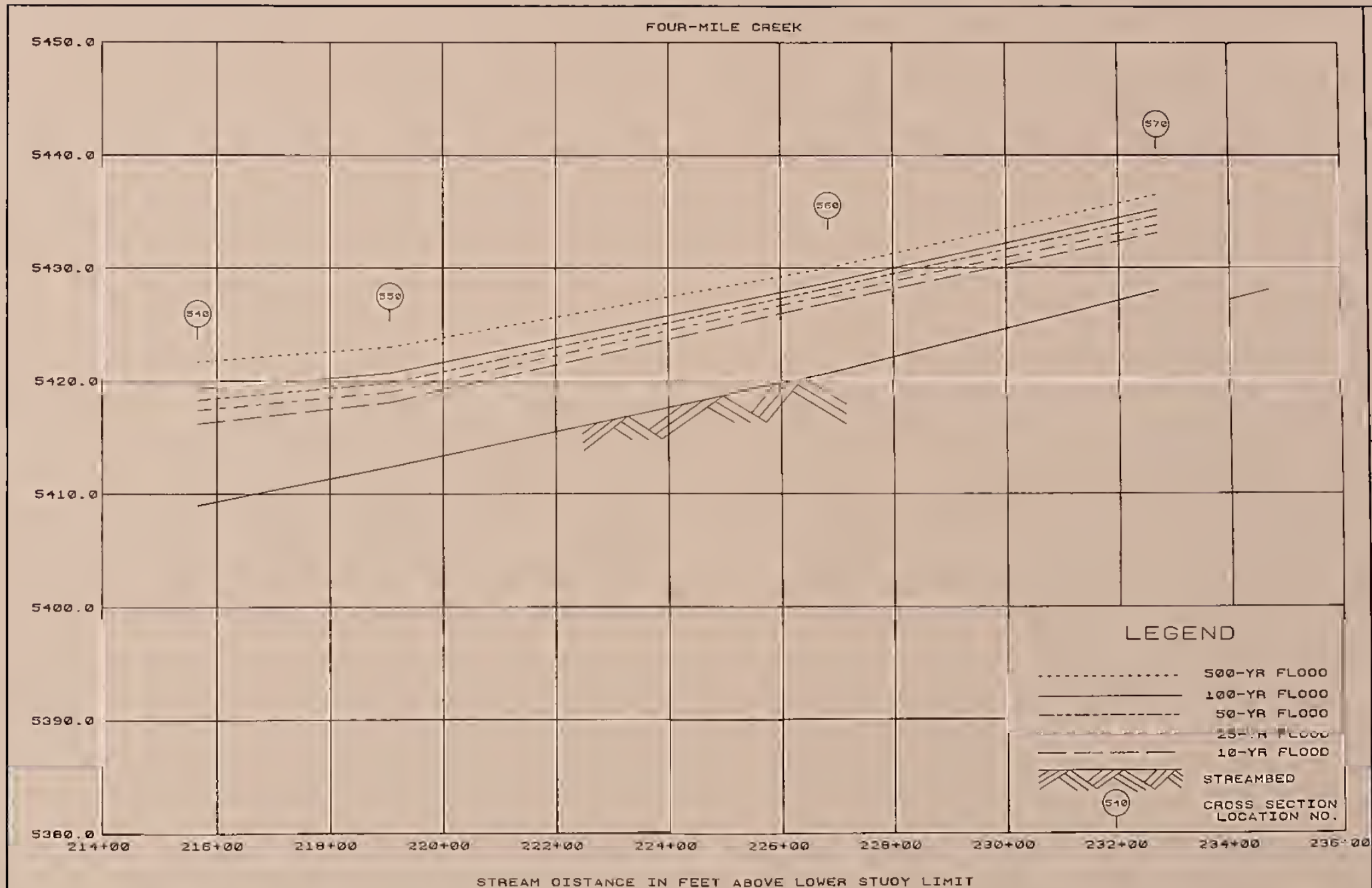






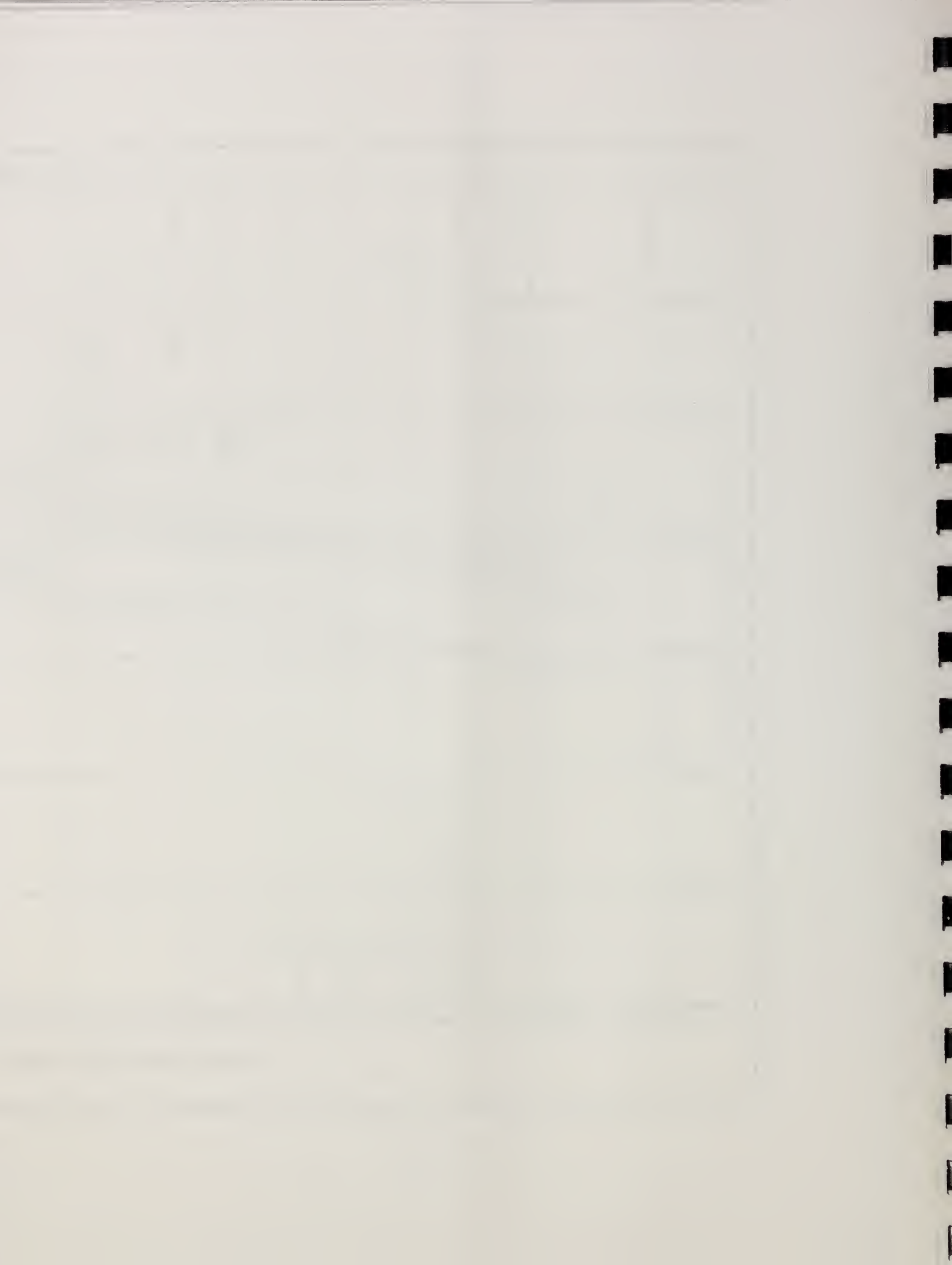






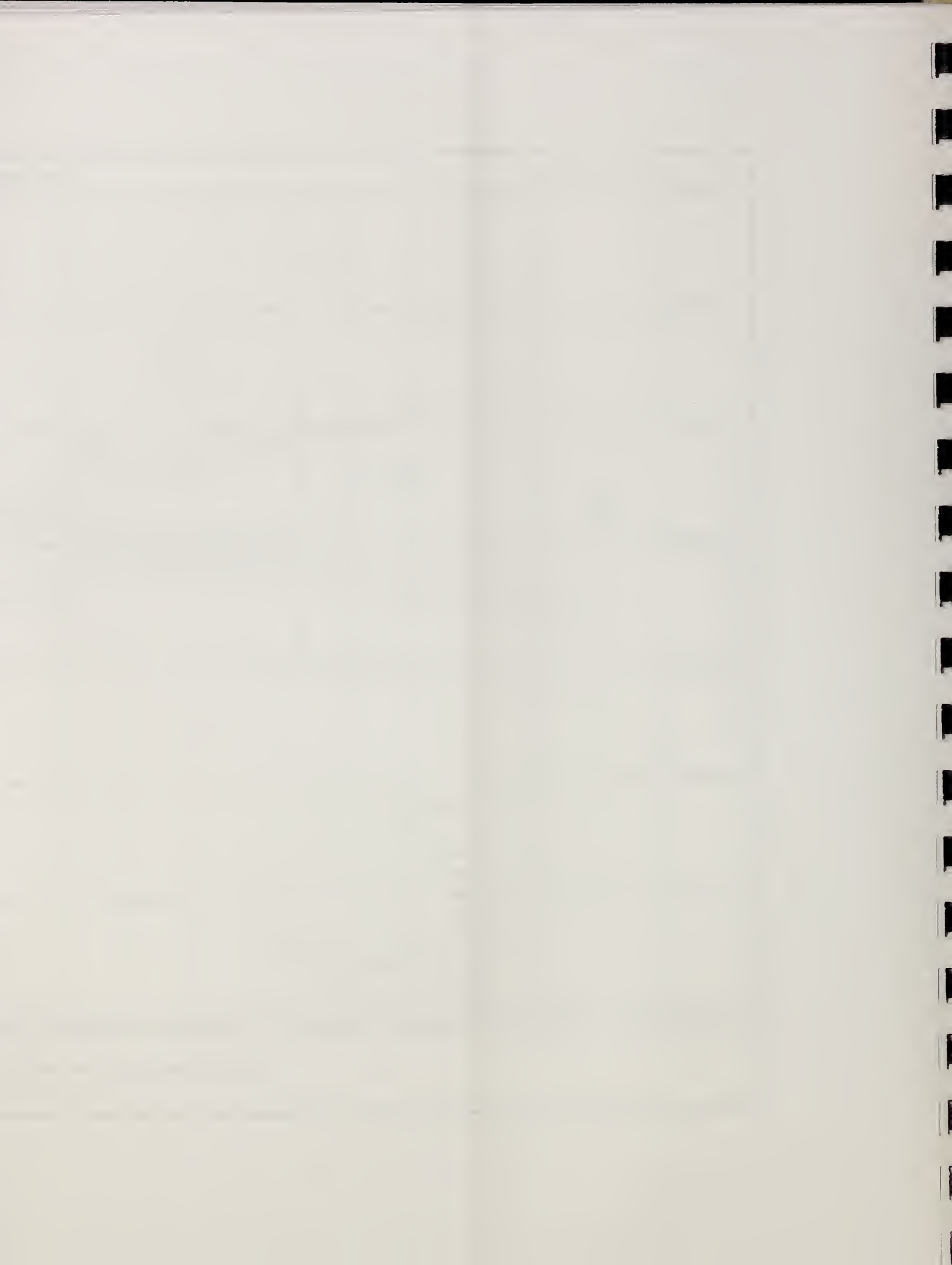


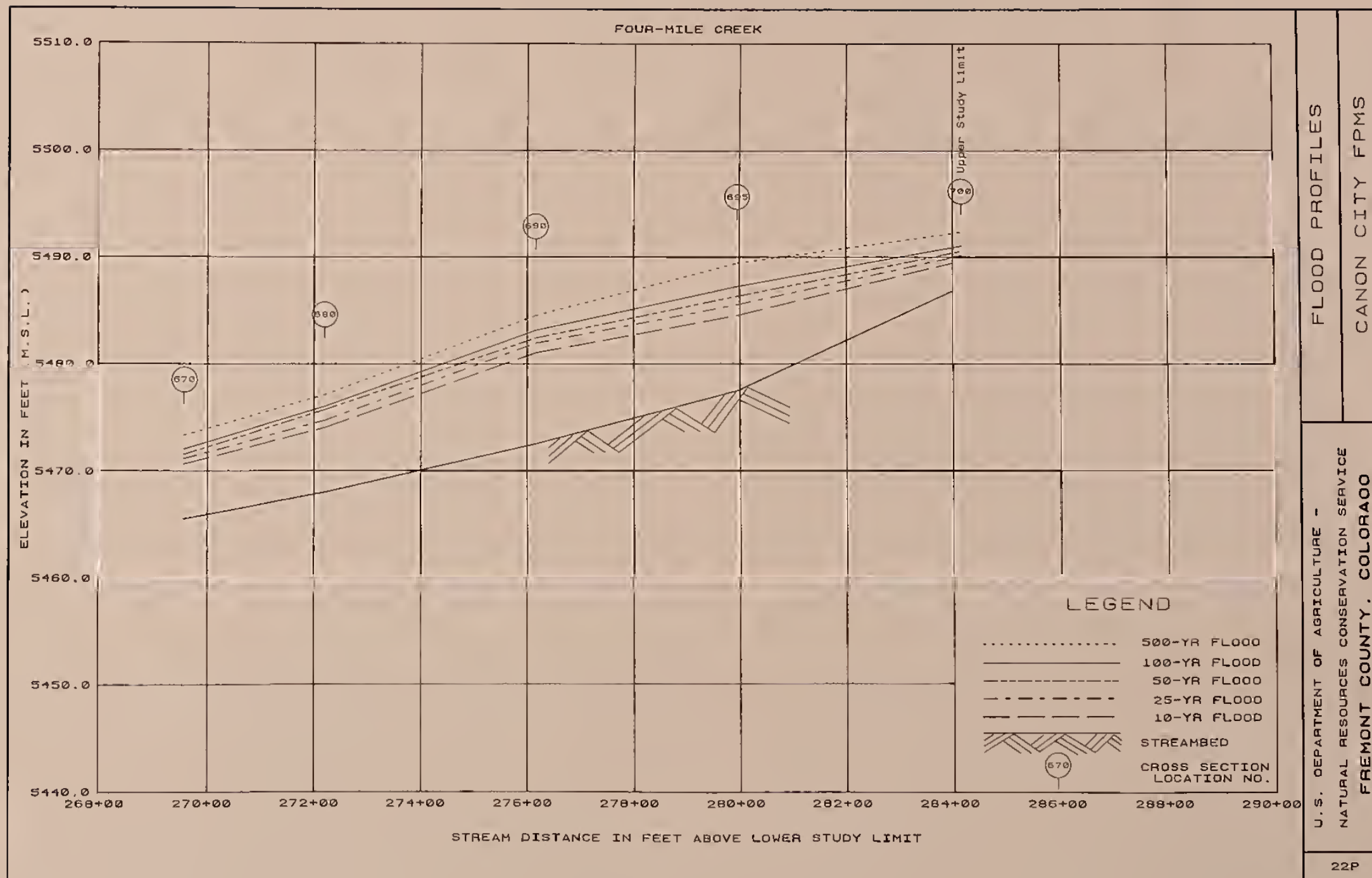












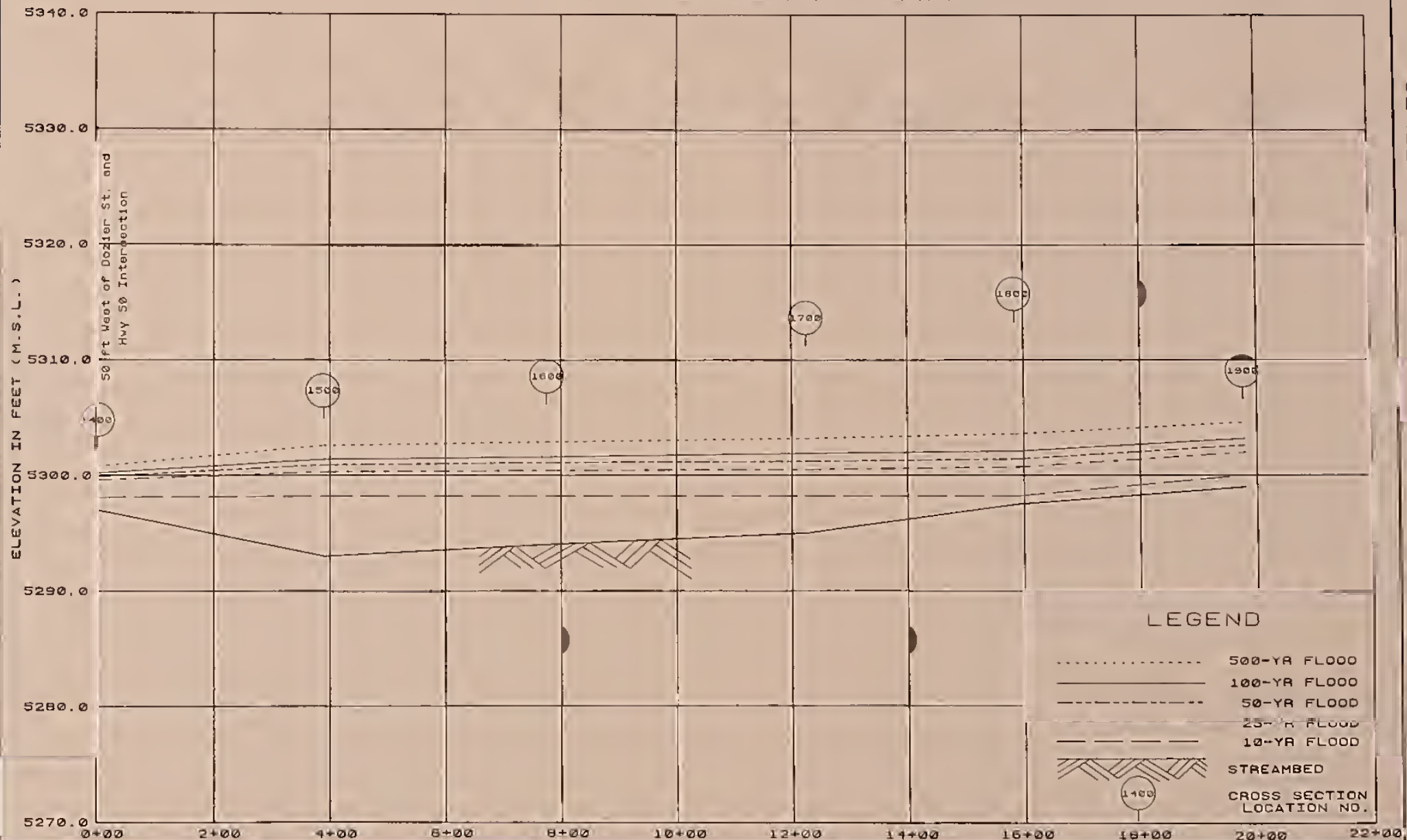








FOUR-MILE CREEK'S OVERBANK BREACH AT X-SECTION 240



LEGEND

- ..... 500-YR FLOOD
- ..... 100-YR FLOOD
- . - . 50-YR FLOOD
- - - - 25-YR FLOOD
- - - - 10-YR FLOOD
- /// STREAMBED
- CROSS SECTION LOCATION NO.

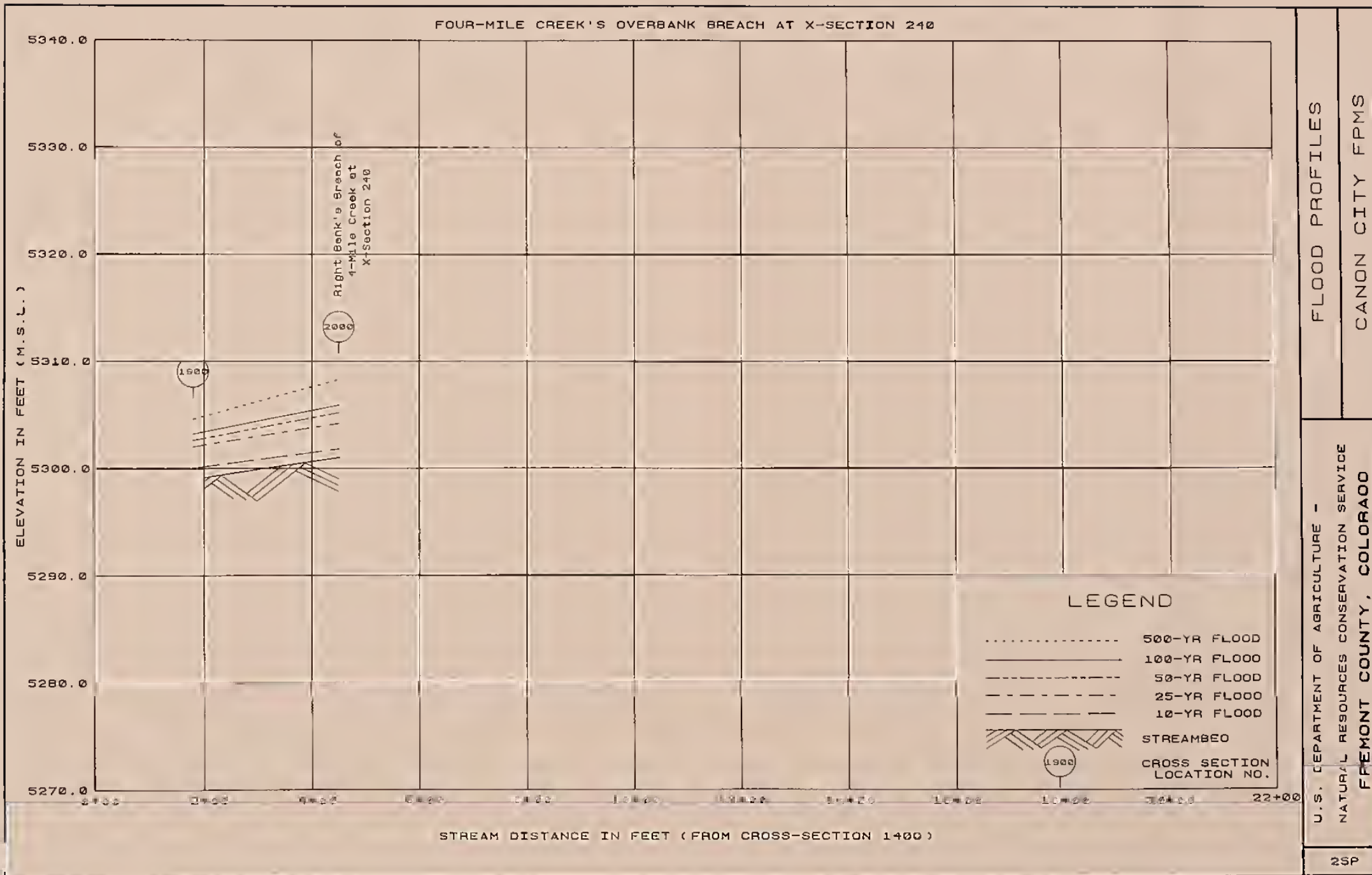
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CANON CITY FPMS

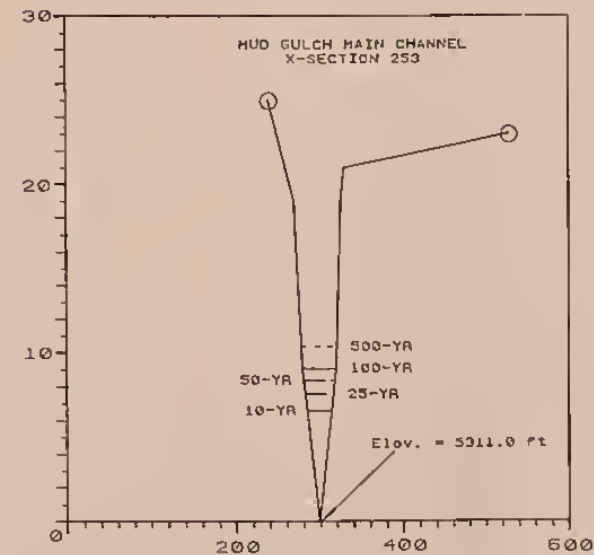
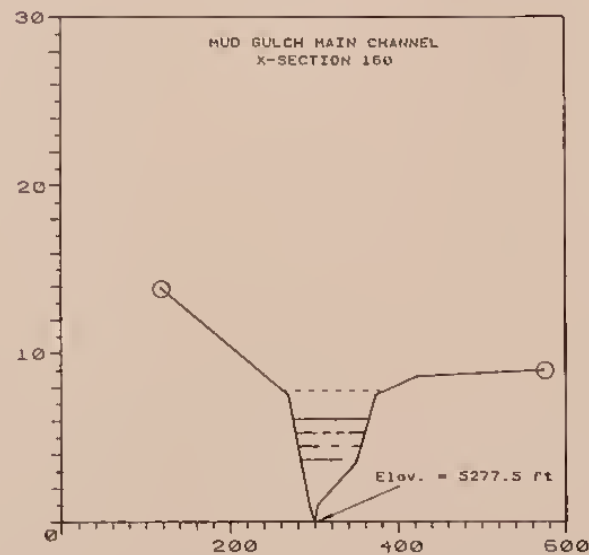
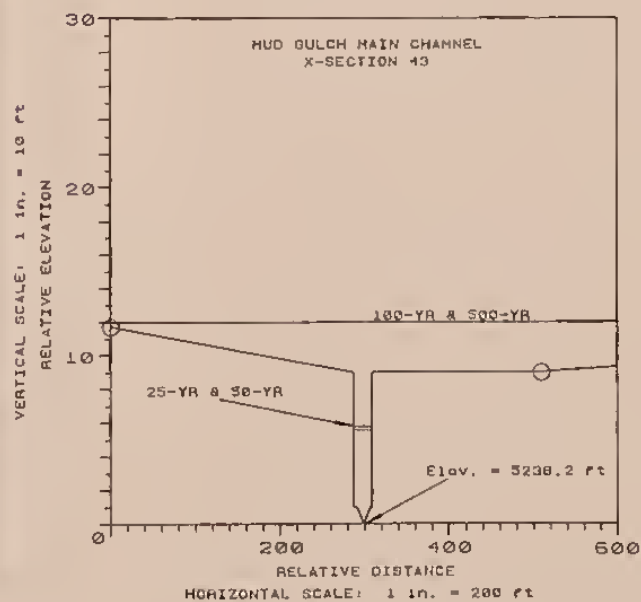
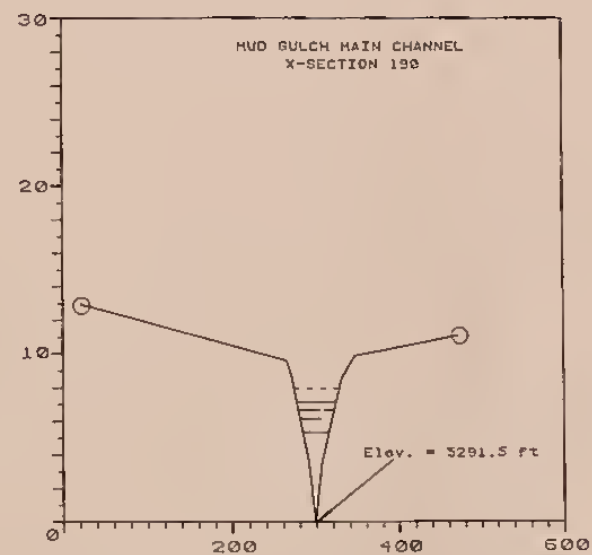
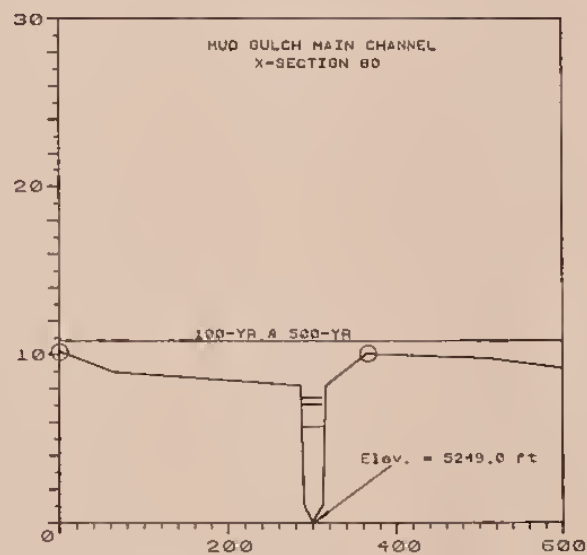
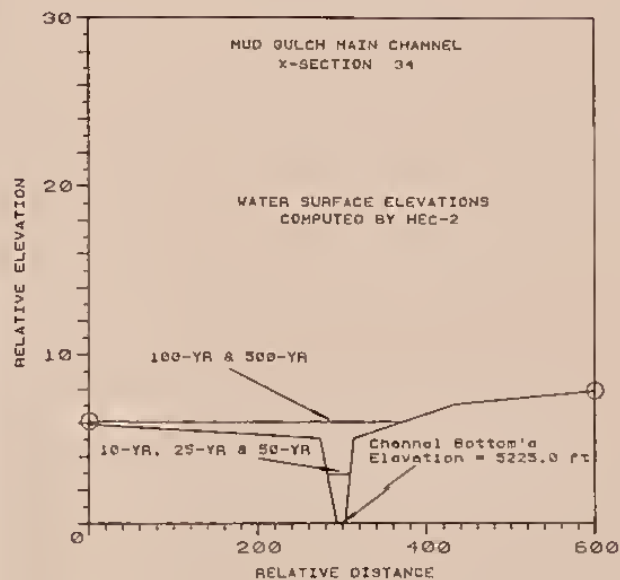
U.S. DEPARTMENT OF AGRICULTURE -  
NATURAL RESOURCES CONSERVATION SERVICE  
FREMONT COUNTY, COLORADO





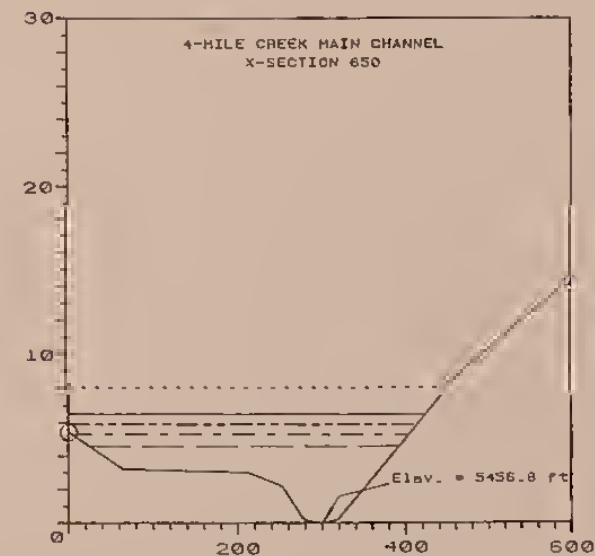
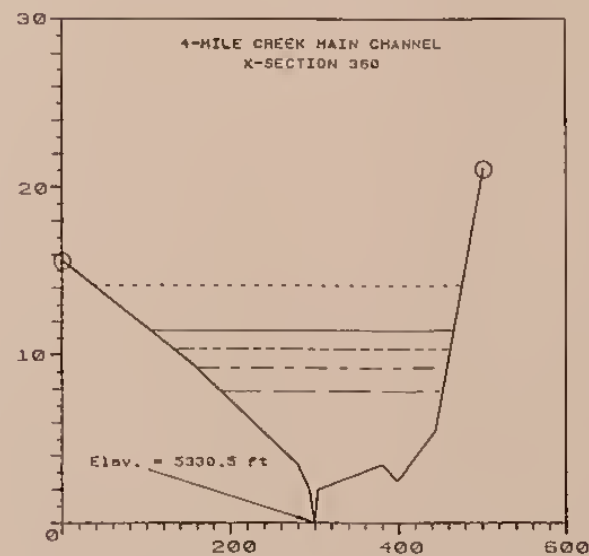
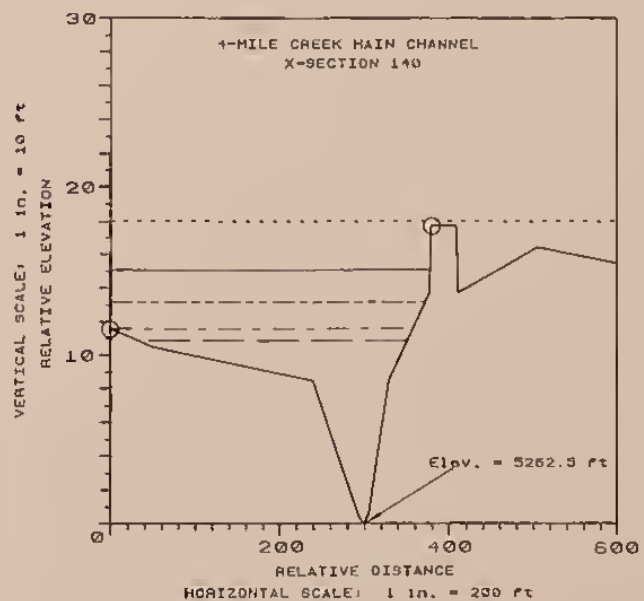
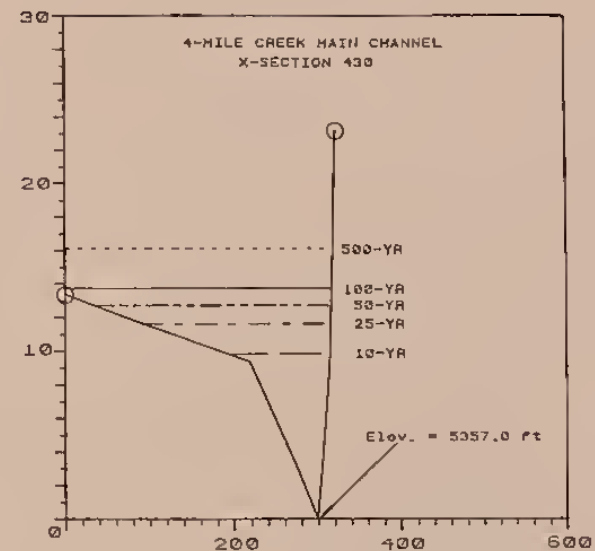
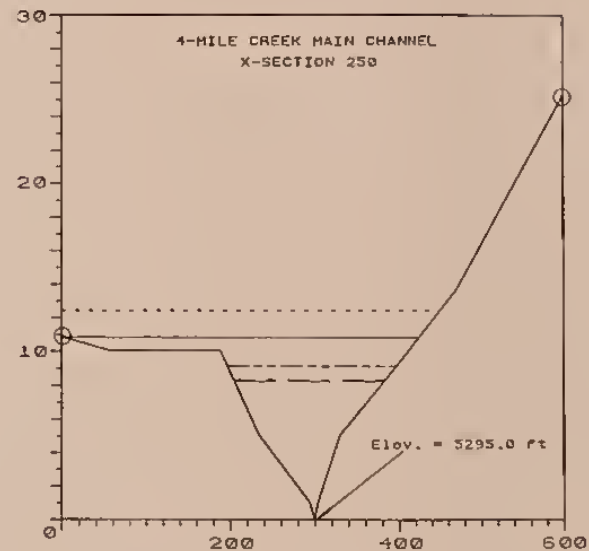
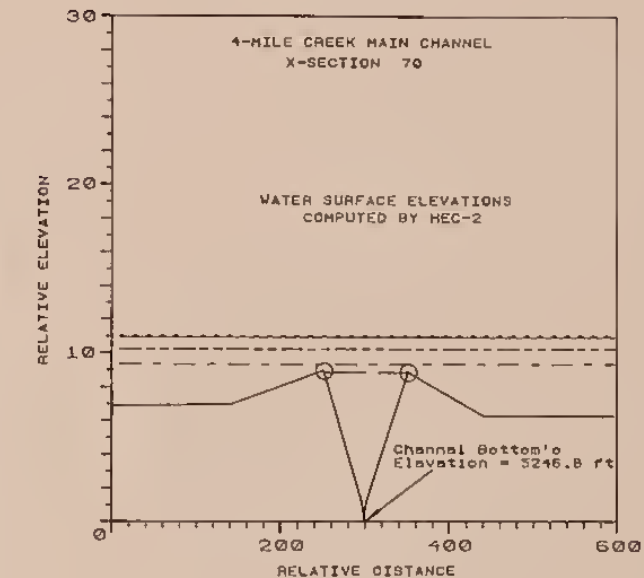












VALLEY CROSS-SECTIONS

CANON CITY FPMs

U.S. DEPARTMENT OF AGRICULTURE -  
NATURAL RESOURCES CONSERVATION SERVICE  
FREMONT COUNTY, COLORADO



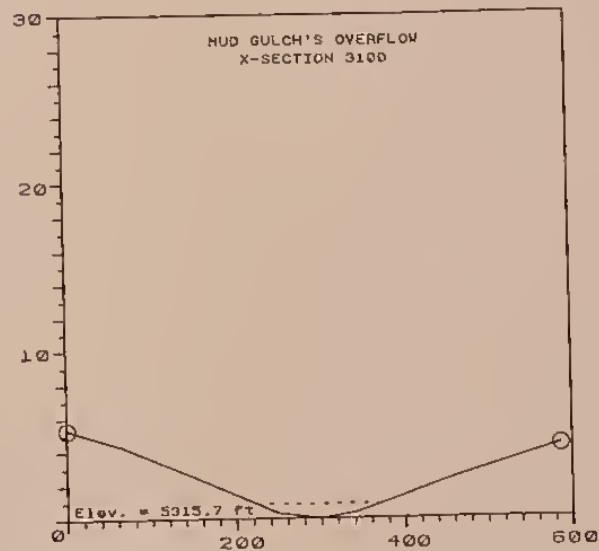
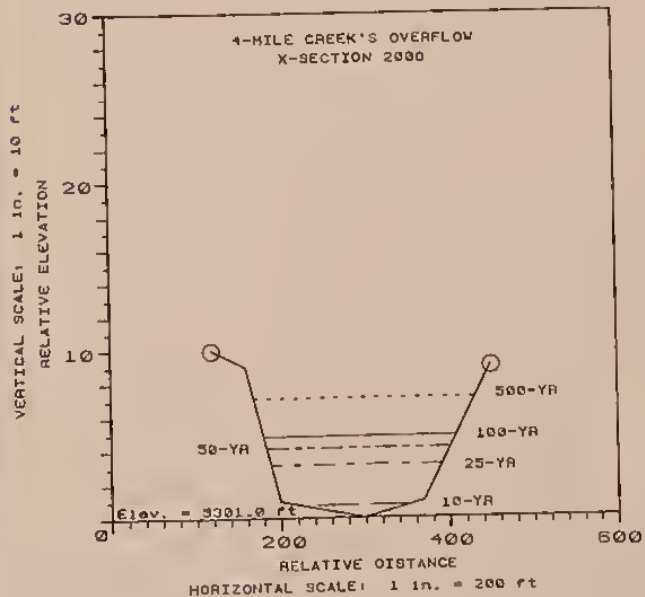
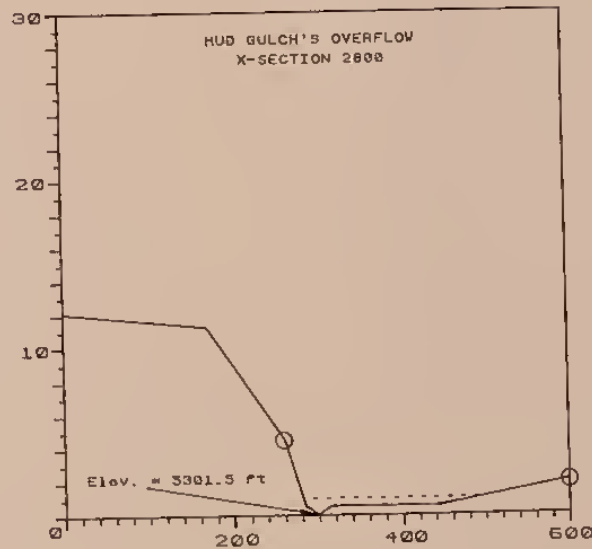
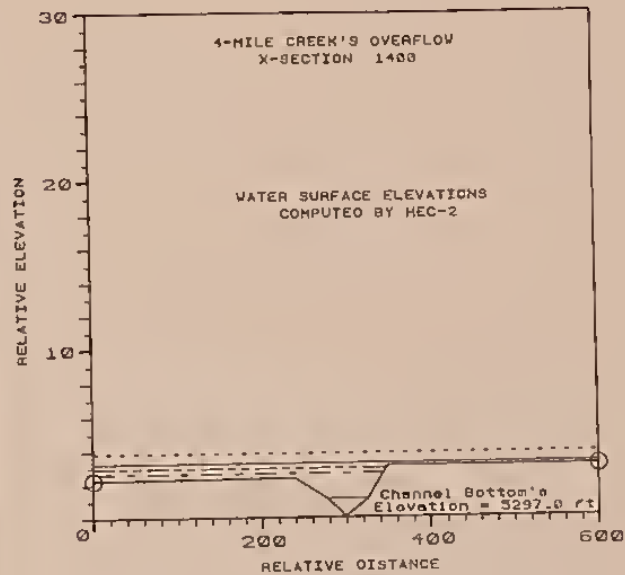






Table 3: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: CANON CITY FPMS

| X-SECT.<br>ID | REACH<br>LENGTH<br>(ft) | STATION<br>DISTANCE<br>(ft) | STREAM<br>BOTTOM<br>ELEV. | 10-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 25-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 50-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 100-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 500-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) |
|---------------|-------------------------|-----------------------------|---------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|
|---------------|-------------------------|-----------------------------|---------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|

## MUD GULCH'S CHANNEL

|       |     |      |        |         |     |         |     |         |      |                      |      |                      |      |
|-------|-----|------|--------|---------|-----|---------|-----|---------|------|----------------------|------|----------------------|------|
| 34.0  | 0   | 0    | 5225.0 | 5227.93 | 245 | 5227.93 | 245 | 5227.93 | 245  | 5231.00 <sup>1</sup> | 245  | 5231.00 <sup>1</sup> | 245  |
| 35.0  | 310 | 310  | 5226.0 | 5230.23 | 245 | 5230.23 | 245 | 5230.23 | 245  | 5233.84 <sup>3</sup> | 245  | 5233.84 <sup>3</sup> | 245  |
| 36.0  | 315 | 625  | 5227.0 | 5231.30 | 245 | 5231.30 | 245 | 5231.30 | 245  | 5236.72 <sup>3</sup> | 245  | 5236.73 <sup>3</sup> | 245  |
| 37.0  | 265 | 890  | 5229.5 | 5233.39 | 245 | 5233.39 | 245 | 5233.39 | 245  | 5239.15 <sup>3</sup> | 245  | 5239.16 <sup>3</sup> | 245  |
| 38.0  | 270 | 1160 | 5232.0 | 5236.00 | 245 | 5236.00 | 245 | 5236.00 | 245  | 5241.62 <sup>3</sup> | 245  | 5241.63 <sup>3</sup> | 245  |
| 39.0  | 275 | 1435 | 5233.0 | 5238.88 | 658 | 5239.03 | 705 | 5239.03 | 705  | 5244.14 <sup>3</sup> | 705  | 5244.15 <sup>3</sup> | 705  |
| 39.5  | 280 | 1715 | 5234.0 | 5242.63 | 658 | 5242.83 | 705 | 5242.83 | 705  | 5246.71 <sup>3</sup> | 705  | 5246.72 <sup>3</sup> | 705  |
| 40.0  | 305 | 2020 | 5235.0 | 5243.62 | 658 | 5243.83 | 705 | 5243.83 | 705  | 5249.50 <sup>2</sup> | 705  | 5249.51 <sup>2</sup> | 705  |
| 43.0  | 120 | 2140 | 5238.2 | 5243.79 | 658 | 5244.00 | 705 | 5244.00 | 705  | 5250.18 <sup>3</sup> | 705  | 5250.19 <sup>3</sup> | 705  |
| 45.0  | 30  | 2170 | 5238.3 | 5244.03 | 658 | 5244.24 | 705 | 5244.24 | 705  | 5250.35 <sup>3</sup> | 705  | 5250.36 <sup>3</sup> | 705  |
| 47.0  | 40  | 2210 | 5239.2 | 5244.25 | 658 | 5244.47 | 705 | 5244.47 | 705  | 5250.58 <sup>3</sup> | 705  | 5250.59 <sup>3</sup> | 705  |
| 50.0  | 70  | 2280 | 5240.7 | 5245.22 | 658 | 5245.41 | 705 | 5245.41 | 705  | 5250.98 <sup>2</sup> | 705  | 5250.99 <sup>2</sup> | 705  |
| 60.0  | 400 | 2680 | 5244.0 | 5249.84 | 658 | 5250.68 | 705 | 5250.68 | 705  | 5252.37 <sup>2</sup> | 705  | 5252.37 <sup>2</sup> | 705  |
| 63.0  | 380 | 3060 | 5245.5 | 5252.39 | 658 | 5253.43 | 975 | 5253.59 | 1090 | 5256.19 <sup>3</sup> | 1090 | 5256.26 <sup>3</sup> | 1090 |
| 67.0  | 80  | 3140 | 5246.4 | 5253.14 | 658 | 5254.15 | 975 | 5254.39 | 1090 | 5257.00 <sup>3</sup> | 1090 | 5257.07 <sup>3</sup> | 1090 |
| 69.0  | 20  | 3160 | 5246.5 | 5253.24 | 658 | 5254.31 | 975 | 5254.66 | 1090 | 5257.20 <sup>3</sup> | 1090 | 5257.28 <sup>3</sup> | 1090 |
| 70.0  | 50  | 3210 | 5246.8 | 5253.72 | 658 | 5255.09 | 975 | 5255.56 | 1090 | 5257.70 <sup>2</sup> | 1090 | 5257.79 <sup>2</sup> | 1090 |
| 80.0  | 390 | 3600 | 5249.0 | 5254.72 | 658 | 5256.01 | 975 | 5256.43 | 1090 | 5259.76 <sup>2</sup> | 1090 | 5259.84 <sup>2</sup> | 1090 |
| 90.0  | 230 | 3830 | 5250.5 | 5255.99 | 658 | 5257.34 | 975 | 5257.78 | 1090 | 5259.74 <sup>2</sup> | 1090 | 5259.77 <sup>2</sup> | 1090 |
| 100.0 | 490 | 4320 | 5256.5 | 5261.45 | 658 | 5262.77 | 975 | 5263.20 | 1090 | 5266.02 <sup>2</sup> | 1090 | 5266.20 <sup>2</sup> | 1090 |
| 101.0 | 85  | 4405 | 5257.3 | 5263.53 | 658 | 5264.78 | 975 | 5266.08 | 1090 | 5266.53 <sup>3</sup> | 1090 | 5266.92 <sup>3</sup> | 1090 |
| 103.0 | 75  | 4480 | 5258.1 | 5264.36 | 658 | 5265.63 | 975 | 5266.72 | 1090 | 5266.97 <sup>3</sup> | 1090 | 5267.55 <sup>3</sup> | 1090 |
| 105.0 | 20  | 4500 | 5258.3 | 5264.53 | 658 | 5265.85 | 975 | 5266.88 | 1090 | 5267.09 <sup>3</sup> | 1090 | 5267.72 <sup>3</sup> | 1090 |
| 110.0 | 20  | 4520 | 5258.5 | 5264.42 | 658 | 5265.77 | 975 | 5266.88 | 1090 | 5267.21 <sup>2</sup> | 1090 | 5267.89 <sup>2</sup> | 1090 |

1 Based on CWSEL(100-year) by Camp Dresser and McKee Inc.

2 4-Mile Creek's Computed Water-Surface Elevations (CWSEL's)

3 Interpolated elevation

Table 3: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: CANON CITY FPMS

| X-SECT.<br>ID | REACH<br>LENGTH<br>(ft) | STATION<br>DISTANCE<br>(ft) | STREAM<br>BOTTOM<br>ELEV. | 10-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 25-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 50-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 100-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 500-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) |
|---------------|-------------------------|-----------------------------|---------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|
|---------------|-------------------------|-----------------------------|---------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|

MUD GULCH'S CHANNEL (continued)

|       |     |      |        |         |     |         |     |         |      |         |      |         |      |
|-------|-----|------|--------|---------|-----|---------|-----|---------|------|---------|------|---------|------|
| 120.0 | 200 | 4720 | 5261.5 | 5267.90 | 658 | 5269.21 | 975 | 5270.00 | 1090 | 5270.00 | 1090 | 5270.00 | 1090 |
| 130.0 | 490 | 5210 | 5263.3 | 5270.94 | 658 | 5272.36 | 975 | 5273.21 | 1241 | 5273.54 | 1517 | 5273.92 | 1880 |
| 135.0 | 285 | 5495 | 5266.5 | 5272.28 | 658 | 5273.55 | 975 | 5274.36 | 1241 | 5274.91 | 1517 | 5275.52 | 1880 |
| 140.0 | 310 | 5805 | 5268.0 | 5275.01 | 658 | 5275.80 | 975 | 5276.39 | 1241 | 5276.94 | 1517 | 5277.57 | 1880 |
| 147.0 | 80  | 5885 | 5268.7 | 5275.65 | 658 | 5276.38 | 975 | 5276.80 | 1241 | 5277.54 | 1517 | 5278.56 | 1880 |
| 149.0 | 20  | 5905 | 5268.8 | 5276.20 | 658 | 5277.56 | 975 | 5278.82 | 1241 | 5279.91 | 1517 | 5281.08 | 1880 |
| 150.0 | 20  | 5925 | 5269.0 | 5277.04 | 658 | 5278.70 | 975 | 5280.04 | 1241 | 5281.24 | 1517 | 5283.00 | 1880 |
| 155.0 | 355 | 6280 | 5273.5 | 5278.90 | 658 | 5280.35 | 975 | 5281.48 | 1241 | 5282.56 | 1517 | 5284.41 | 2072 |
| 160.0 | 305 | 6585 | 5277.5 | 5281.23 | 595 | 5282.03 | 869 | 5282.78 | 1106 | 5283.60 | 1350 | 5285.29 | 1819 |
| 170.0 | 250 | 6835 | 5280.2 | 5284.64 | 595 | 5284.98 | 869 | 5285.10 | 1106 | 5285.40 | 1350 | 5286.11 | 1819 |
| 180.0 | 470 | 7305 | 5284.5 | 5289.92 | 595 | 5291.06 | 869 | 5291.87 | 1106 | 5292.44 | 1350 | 5293.26 | 1819 |
| 190.0 | 460 | 7765 | 5291.5 | 5296.84 | 595 | 5297.59 | 869 | 5298.10 | 1106 | 5298.56 | 1350 | 5299.42 | 1819 |
| 200.0 | 290 | 8055 | 5295.0 | 5299.36 | 595 | 5300.31 | 869 | 5301.05 | 1106 | 5301.62 | 1350 | 5302.47 | 1819 |
| 210.0 | 420 | 8475 | 5296.6 | 5301.13 | 595 | 5301.88 | 869 | 5302.45 | 1106 | 5302.91 | 1350 | 5303.71 | 1819 |
| 211.0 | 100 | 8575 | 5297.0 | 5302.74 | 595 | 5303.69 | 869 | 5304.35 | 1106 | 5304.95 | 1350 | 5305.87 | 1819 |
| 213.0 | 150 | 8725 | 5299.0 | 5303.82 | 595 | 5306.27 | 869 | 5308.66 | 1106 | 5311.48 | 1350 | 5317.91 | 1819 |
| 215.0 | 25  | 8750 | 5300.2 | 5304.40 | 595 | 5306.21 | 869 | 5308.71 | 1106 | 5311.61 | 1350 | 5318.06 | 1819 |
| 230.0 | 20  | 8770 | 5300.5 | 5305.16 | 549 | 5306.31 | 814 | 5308.73 | 1043 | 5311.62 | 1278 | 5318.06 | 1720 |
| 240.0 | 100 | 8870 | 5304.5 | 5307.43 | 549 | 5308.16 | 814 | 5308.71 | 1043 | 5311.33 | 1278 | 5317.99 | 1720 |
| 250.0 | 265 | 9135 | 5305.3 | 5310.20 | 549 | 5311.05 | 814 | 5311.69 | 1043 | 5312.43 | 1278 | 5318.10 | 1895 |
| 250.5 | 330 | 9465 | 5309.5 | 5311.97 | 549 | 5312.64 | 814 | 5313.17 | 1043 | 5313.71 | 1278 | 5318.27 | 1895 |
| 251.0 | 325 | 9790 | 5310.5 | 5316.34 | 549 | 5317.02 | 814 | 5317.46 | 1043 | 5317.90 | 1278 | 5319.15 | 1895 |
| 253.0 | 100 | 9890 | 5311.0 | 5317.55 | 549 | 5318.59 | 814 | 5319.36 | 1043 | 5320.05 | 1278 | 5321.42 | 1895 |
| 254.0 | 50  | 9940 | 5311.5 | 5317.69 | 549 | 5318.63 | 814 | 5319.28 | 1043 | 5319.86 | 1278 | 5320.95 | 1895 |

Table 2: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: CANON CITY FPMS

| X-SECT. | REACH  | STATION  | STREAM | 10-YEAR FREQ. | 25-YEAR FREQ. | 50-YEAR FREQ. | 100-YEAR FREQ. | 500-YEAR FREQ. |
|---------|--------|----------|--------|---------------|---------------|---------------|----------------|----------------|
| ID      | LENGTH | DISTANCE | BOTTOM | FLOOD         | FLOOD         | FLOOD         | FLOOD          | FLOOD          |
|         | (ft)   | (ft)     | ELEV.  | ELEV. Q(cfs)  | ELEV. Q(cfs)  | ELEV. Q(cfs)  | ELEV. Q(cfs)   | ELEV. Q(cfs)   |

## MUD GULCH'S CHANNEL (continued)

|       |    |       |        |         |     |         |     |         |      |         |      |         |      |
|-------|----|-------|--------|---------|-----|---------|-----|---------|------|---------|------|---------|------|
| 254.5 | 20 | 9960  | 5311.8 | 5317.87 | 549 | 5318.84 | 814 | 5319.54 | 1043 | 5320.15 | 1278 | 5322.57 | 1895 |
| 254.7 | 20 | 9980  | 5313.7 | 5319.89 | 549 | 5320.90 | 814 | 5321.66 | 1043 | 5322.32 | 1278 | 5323.80 | 1895 |
| 255.0 | 60 | 10040 | 5314.7 | 5321.41 | 549 | 5322.48 | 814 | 5323.22 | 1043 | 5323.89 | 1278 | 5325.31 | 1895 |

## MUD GULCH'S BANK-OVERFLOWED CHANNEL

|      |     |     |        |      |   |      |   |      |   |      |   |         |     |
|------|-----|-----|--------|------|---|------|---|------|---|------|---|---------|-----|
| 2800 | 0   | 0   | 5301.5 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 5302.50 | 175 |
| 2900 | 170 | 170 | 5303.0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 5303.83 | 175 |
| 3000 | 460 | 630 | 5311.5 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 5312.60 | 175 |
| 3100 | 270 | 900 | 5315.7 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 5316.56 | 175 |

Table 3: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: CANON CITY FPMS

| X-SECT.<br>ID | REACH<br>LENGTH<br>(ft) | STATION<br>DISTANCE<br>(ft) | STREAM<br>BOTTOM<br>ELEV. | 10-YEAR FREQ.  |        | 25-YEAR FREQ.  |        | 50-YEAR FREQ.  |        | 100-YEAR FREQ. |        | 500-YEAR FREQ. |        |
|---------------|-------------------------|-----------------------------|---------------------------|----------------|--------|----------------|--------|----------------|--------|----------------|--------|----------------|--------|
|               |                         |                             |                           | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) |

## FOUR-MILE CREEK'S CHANNEL

|       |     |      |        |          |      |          |      |          |      |          |       |          |       |
|-------|-----|------|--------|----------|------|----------|------|----------|------|----------|-------|----------|-------|
| 40    | 0   | 0    | 5240.5 | 5248.52  | 4387 | 5249.46  | 5912 | 5249.49  | 8813 | 5249.50  | 12331 | 5249.51  | 23242 |
| 50    | 260 | 260  | 5240.7 | 5249.71* | 4387 | 5249.99  | 5912 | 5250.97  | 8813 | 5250.98  | 12331 | 5250.99  | 23242 |
| 60    | 395 | 655  | 5244.0 | 5251.52  | 4387 | 5252.38  | 5912 | 5252.36  | 8813 | 5252.37  | 12331 | 5252.37  | 23242 |
| 70    | 500 | 1155 | 5246.8 | 5255.65* | 4387 | 5256.09  | 5642 | 5257.61  | 8428 | 5257.70  | 11946 | 5257.79  | 22857 |
| 80    | 450 | 1605 | 5249.0 | 5259.37  | 4387 | 5259.51  | 5642 | 5259.66  | 8428 | 5259.76  | 11946 | 5259.84  | 22857 |
| 90    | 220 | 1825 | 5250.5 | 5259.51* | 4387 | 5259.51  | 5642 | 5259.65  | 8428 | 5259.74  | 11946 | 5259.77  | 22857 |
| 100   | 560 | 2385 | 5255.0 | 5262.84  | 4387 | 5263.75  | 5642 | 5265.05  | 8428 | 5266.02  | 11946 | 5266.20  | 22857 |
| 110   | 200 | 2585 | 5256.0 | 5264.50* | 4387 | 5265.06* | 5642 | 5266.26* | 8428 | 5267.21* | 11946 | 5267.89* | 22857 |
| 120   | 210 | 2795 | 5256.5 | 5266.25  | 4387 | 5266.44* | 5642 | 5267.54* | 8428 | 5268.46* | 11946 | 5269.67* | 22857 |
| 130   | 460 | 3255 | 5260.0 | 5268.87  | 4387 | 5269.45* | 5642 | 5270.33* | 8277 | 5271.20* | 11519 | 5273.57* | 22067 |
| 132   | 310 | 3565 | 5261.1 | 5270.98  | 4387 | 5271.48  | 5642 | 5272.21  | 8277 | 5273.05  | 11519 | 5276.20  | 22067 |
| 134   | 100 | 3665 | 5261.6 | 5272.38  | 4387 | 5273.01  | 5642 | 5273.72* | 8277 | 5275.38  | 11519 | 5276.47* | 22067 |
| 136   | 10  | 3675 | 5261.7 | 5272.45  | 4387 | 5272.96  | 5642 | 5273.87  | 8277 | 5274.66  | 11519 | 5276.49* | 22067 |
| 136.5 | 25  | 3700 | 5261.8 | 5272.48  | 4387 | 5273.00  | 5642 | 5273.94  | 8277 | 5274.77  | 11519 | 5276.56  | 22067 |
| 138   | 10  | 3710 | 5261.9 | 5272.61  | 4387 | 5273.48  | 5642 | 5275.24  | 8277 | 5277.32  | 11519 | 5284.48  | 22067 |
| 138.5 | 50  | 3760 | 5262.1 | 5272.96  | 4387 | 5273.74  | 5642 | 5275.38  | 8277 | 5277.44  | 11519 | 5284.48  | 22067 |
| 140   | 85  | 3845 | 5262.5 | 5273.45  | 4387 | 5274.15  | 5642 | 5275.66  | 8277 | 5277.65  | 11519 | 5284.48  | 22067 |
| 142   | 90  | 3935 | 5263.7 | 5273.40  | 4387 | 5274.60* | 5642 | 5276.68  | 8277 | 5278.64  | 11519 | 5284.48  | 22067 |
| 146   | 10  | 3945 | 5263.8 | 5273.51  | 4387 | 5274.65  | 5642 | 5276.67  | 8277 | 5279.49  | 11519 | 5284.48  | 22067 |
| 148   | 20  | 3965 | 5264.0 | 5273.80  | 4387 | 5274.91  | 5642 | 5277.26  | 8277 | 5280.24  | 11519 | 5284.48  | 22067 |
| 150   | 10  | 3975 | 5264.5 | 5274.00  | 4387 | 5275.15  | 5642 | 5277.36* | 8277 | 5280.30  | 11519 | 5284.50  | 22067 |
| 154   | 50  | 4025 | 5264.6 | 5274.49  | 4387 | 5275.63  | 5642 | 5277.85* | 8277 | 5280.33  | 11519 | 5284.50  | 22067 |
| 155   | 325 | 4350 | 5266.2 | 5277.88  | 4387 | 5279.11  | 5642 | 5281.06  | 8277 | 5281.39  | 11519 | 5284.48  | 21875 |
| 160   | 315 | 4665 | 5268.0 | 5279.16  | 4387 | 5280.11  | 5642 | 5281.44  | 8277 | 5281.94  | 11519 | 5285.28* | 21875 |

\* Interpolated elevation



Table 3: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: CANON CITY FPMS

| X-SECT.<br>ID | REACH<br>LENGTH<br>(ft) | STATION<br>DISTANCE<br>(ft) | STREAM<br>BOTTOM<br>ELEV. | 10-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 25-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 50-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 100-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) | 500-YEAR FREQ.<br>FLOOD<br>ELEV. Q(cfs) |
|---------------|-------------------------|-----------------------------|---------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|
|---------------|-------------------------|-----------------------------|---------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|

FOUR-MILE CREEK'S CHANNEL (continued)

|     |     |       |        |          |      |          |      |          |      |          |       |          |        |
|-----|-----|-------|--------|----------|------|----------|------|----------|------|----------|-------|----------|--------|
| 170 | 250 | 4915  | 5269.0 | 5280.50  | 4387 | 5281.38  | 5642 | 5282.77  | 8277 | 5284.14  | 11519 | 5285.92  | 21875  |
| 180 | 465 | 5380  | 5273.0 | 5282.10  | 4387 | 5282.93  | 5642 | 5284.25  | 8277 | 5285.82  | 11519 | 5287.53  | 21875  |
| 190 | 470 | 5850  | 5276.0 | 5283.97  | 4387 | 5284.71  | 5642 | 5285.98  | 8277 | 5287.29  | 11519 | 5289.48  | 21875  |
| 193 | 470 | 6320  | 5279.5 | 5285.65  | 4387 | 5285.66  | 4393 | 5286.64  | 4400 | 5287.93  | 4407  | 5290.46  | 4431   |
| 195 | 440 | 6760  | 5283.5 | 5290.82* | 4387 | 5290.83* | 4393 | 5291.47* | 4400 | 5292.12* | 4407  | 5293.38* | 4431   |
| 200 | 430 | 7190  | 5287.0 | 5295.87  | 4387 | 5295.88  | 4393 | 5296.20  | 4400 | 5296.21  | 4407  | 5296.23  | 4431   |
| 206 | 305 | 7495  | 5288.6 | 5298.24  | 4387 | 5298.25  | 4393 | 5298.24  | 4400 | 5298.25  | 4407  | 5298.26  | 4431   |
| 210 | 430 | 7925  | 5290.6 | 5301.37  | 4387 | 5301.37  | 4393 | 5301.38  | 4400 | 5301.39  | 4407  | 5301.41  | 4431   |
| 212 | 50  | 7975  | 5291.2 | 5301.58  | 4387 | 5301.58  | 4393 | 5301.59  | 4400 | 5301.60  | 4407  | 5301.62  | 4431   |
| 214 | 110 | 8085  | 5291.7 | 5301.59  | 4375 | 5301.60  | 4375 | 5301.61  | 4375 | 5301.61  | 4375  | 5301.64  | 4375   |
| 230 | 75  | 8160  | 5292.3 | 5301.69  | 4375 | 5301.70  | 4375 | 5301.70  | 4375 | 5301.71  | 4375  | 5301.73  | 4375   |
| 240 | 95  | 8255  | 5293.5 | 5301.96  | 4375 | 5301.97  | 4375 | 5301.97  | 4375 | 5301.98  | 4375  | 5302.00  | 4375   |
| 250 | 220 | 8475  | 5295.0 | 5303.20  | 4433 | 5303.34  | 7124 | 5304.12  | 9752 | 5305.82  | 12987 | 5307.31  | 23319* |
| 260 | 500 | 8975  | 5298.5 | 5307.87  | 4433 | 5309.87  | 7124 | 5310.98  | 9752 | 5311.88  | 12987 | 5314.18  | 23319  |
| 270 | 360 | 9335  | 5300.0 | 5309.98  | 4433 | 5311.59  | 7124 | 5312.73  | 9752 | 5313.81  | 12987 | 5316.54  | 23319  |
| 280 | 350 | 9685  | 5301.2 | 5310.73  | 4433 | 5312.46  | 7124 | 5313.97  | 9752 | 5315.08  | 12987 | 5317.91  | 23319  |
| 290 | 415 | 10100 | 5305.5 | 5313.28  | 4433 | 5314.54  | 7124 | 5315.79  | 9752 | 5316.65  | 12987 | 5319.14  | 23319  |
| 300 | 390 | 10490 | 5308.0 | 5317.05  | 4433 | 5317.35  | 7124 | 5317.82  | 9752 | 5318.34  | 12987 | 5320.05  | 23319  |
| 310 | 360 | 10850 | 5314.0 | 5322.08  | 4433 | 5323.03  | 7124 | 5323.58  | 9752 | 5324.16  | 12987 | 5325.26  | 23319  |
| 320 | 320 | 11170 | 5317.5 | 5325.17  | 4433 | 5325.95  | 7124 | 5326.65  | 9752 | 5327.38  | 12987 | 5329.32  | 23319  |
| 330 | 540 | 11710 | 5321.5 | 5328.84  | 4433 | 5329.89  | 7124 | 5330.68  | 9752 | 5331.62  | 12987 | 5333.55  | 23319  |
| 340 | 500 | 12210 | 5325.4 | 5332.83  | 4433 | 5333.74  | 7124 | 5334.27  | 9752 | 5334.91  | 12987 | 5336.17  | 23319  |
| 350 | 415 | 12625 | 5329.7 | 5337.07  | 4433 | 5338.32  | 7124 | 5339.17  | 9752 | 5339.92  | 12987 | 5342.36  | 23319  |
| 360 | 255 | 12880 | 5330.5 | 5338.39  | 4433 | 5339.81  | 7124 | 5340.89  | 9752 | 5341.98  | 12987 | 5344.65  | 23319  |

\* Interpolated Elevation

Table 3: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: CANON CITY FPMS

| X-SECT.<br>ID | REACH<br>LENGTH<br>(ft) | STATION<br>DISTANCE<br>(ft) | STREAM<br>BOTTOM<br>ELEV. | 10-YEAR FREQ.  |        | 25-YEAR FREQ.  |        | 50-YEAR FREQ.  |        | 100-YEAR FREQ. |        | 500-YEAR FREQ. |        |
|---------------|-------------------------|-----------------------------|---------------------------|----------------|--------|----------------|--------|----------------|--------|----------------|--------|----------------|--------|
|               |                         |                             |                           | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) |

FOUR-MILE CREEK'S CHANNEL (continued)

|     |     |       |        |         |      |         |      |         |      |         |       |         |       |
|-----|-----|-------|--------|---------|------|---------|------|---------|------|---------|-------|---------|-------|
| 370 | 700 | 13580 | 5334.7 | 5343.59 | 4433 | 5344.42 | 7124 | 5345.01 | 9752 | 5345.91 | 12987 | 5348.04 | 23319 |
| 380 | 680 | 14260 | 5341.0 | 5350.28 | 4433 | 5351.20 | 7124 | 5351.81 | 9752 | 5352.24 | 12987 | 5353.33 | 23319 |
| 390 | 310 | 14570 | 5344.5 | 5352.28 | 4433 | 5353.11 | 7124 | 5353.68 | 9752 | 5354.29 | 12987 | 5355.79 | 23319 |
| 400 | 375 | 14945 | 5348.5 | 5356.29 | 4433 | 5356.93 | 7124 | 5357.44 | 9752 | 5357.99 | 12987 | 5359.43 | 23319 |
| 410 | 350 | 15295 | 5351.0 | 5359.10 | 4416 | 5359.96 | 7096 | 5360.65 | 9714 | 5361.35 | 12938 | 5363.08 | 23061 |
| 420 | 390 | 15685 | 5353.0 | 5362.47 | 4416 | 5363.67 | 7096 | 5364.55 | 9714 | 5365.43 | 12938 | 5367.47 | 23061 |
| 430 | 420 | 16105 | 5357.0 | 5366.75 | 4416 | 5368.65 | 7096 | 5369.72 | 9714 | 5370.73 | 12938 | 5373.00 | 23061 |
| 440 | 730 | 16835 | 5364.3 | 5373.28 | 4416 | 5374.42 | 7096 | 5375.26 | 9714 | 5376.14 | 12938 | 5378.29 | 23061 |
| 450 | 350 | 17185 | 5368.5 | 5376.15 | 4416 | 5376.75 | 7096 | 5377.34 | 9714 | 5378.02 | 12938 | 5379.91 | 23061 |
| 460 | 490 | 17675 | 5371.5 | 5379.82 | 4416 | 5380.65 | 7096 | 5381.23 | 9714 | 5381.79 | 12938 | 5383.21 | 23061 |
| 470 | 370 | 18045 | 5375.0 | 5383.48 | 4416 | 5384.10 | 7096 | 5384.63 | 9714 | 5385.16 | 12938 | 5386.84 | 23061 |
| 480 | 310 | 18355 | 5378.5 | 5386.69 | 4416 | 5388.70 | 7096 | 5389.13 | 9714 | 5389.61 | 12938 | 5390.56 | 23061 |
| 490 | 685 | 19040 | 5384.5 | 5392.00 | 4416 | 5393.66 | 7096 | 5394.22 | 9714 | 5394.80 | 12938 | 5396.43 | 23061 |
| 500 | 400 | 19440 | 5388.5 | 5396.66 | 4416 | 5397.14 | 7096 | 5397.78 | 9714 | 5398.34 | 12938 | 5399.77 | 23061 |
| 510 | 840 | 20280 | 5396.5 | 5403.78 | 4416 | 5405.17 | 7096 | 5405.92 | 9714 | 5406.61 | 12938 | 5408.32 | 23061 |
| 520 | 555 | 20835 | 5403.5 | 5409.25 | 4416 | 5409.98 | 7096 | 5410.71 | 9714 | 5411.56 | 12938 | 5413.79 | 23061 |
| 530 | 295 | 21130 | 5406.5 | 5411.94 | 4416 | 5412.98 | 7096 | 5413.89 | 9714 | 5414.75 | 12938 | 5416.72 | 23061 |
| 540 | 435 | 21565 | 5409.0 | 5416.16 | 4416 | 5417.35 | 7096 | 5418.27 | 9714 | 5419.21 | 12938 | 5421.62 | 23061 |
| 550 | 340 | 21905 | 5412.4 | 5418.11 | 4416 | 5419.03 | 7096 | 5419.80 | 9714 | 5420.67 | 12938 | 5422.91 | 23061 |
| 560 | 780 | 22685 | 5420.7 | 5426.93 | 4416 | 5427.63 | 7096 | 5428.16 | 9714 | 5428.68 | 12938 | 5429.94 | 23061 |
| 570 | 585 | 23270 | 5428.0 | 5433.10 | 4416 | 5433.81 | 7096 | 5434.65 | 9714 | 5435.18 | 12938 | 5436.45 | 23061 |
| 580 | 635 | 23905 | 5434.2 | 5439.61 | 4416 | 5440.32 | 7096 | 5440.91 | 9714 | 5441.45 | 12938 | 5442.77 | 23061 |
| 590 | 245 | 24150 | 5435.6 | 5441.17 | 4416 | 5441.94 | 7096 | 5442.55 | 9714 | 5443.20 | 12938 | 5444.78 | 23061 |
| 600 | 425 | 24575 | 5441.2 | 5445.85 | 4416 | 5446.55 | 7096 | 5447.14 | 9714 | 5447.77 | 12938 | 5449.39 | 23061 |

Table 3: FLOOD FREQUENCY - ELEVATION AND DISCHARGE DATA

PROJECT: CANON CITY FPMS

| X-SECT.<br>ID | REACH<br>LENGTH<br>(ft) | STATION<br>DISTANCE<br>(ft) | STREAM<br>BOTTOM<br>ELEV. | 10-YEAR FREQ.  |        | 25-YEAR FREQ.  |        | 50-YEAR FREQ.  |        | 100-YEAR FREQ. |        | 500-YEAR FREQ. |        |
|---------------|-------------------------|-----------------------------|---------------------------|----------------|--------|----------------|--------|----------------|--------|----------------|--------|----------------|--------|
|               |                         |                             |                           | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) | FLOOD<br>ELEV. | Q(cfs) |

## FOUR-MILE CREEK'S CHANNEL (continued)

|     |     |       |        |         |      |         |      |         |      |         |       |         |       |
|-----|-----|-------|--------|---------|------|---------|------|---------|------|---------|-------|---------|-------|
| 610 | 140 | 24715 | 5443.0 | 5448.09 | 4416 | 5448.60 | 7096 | 5449.01 | 9714 | 5449.43 | 12938 | 5451.02 | 23061 |
| 620 | 370 | 25085 | 5446.3 | 5451.62 | 4416 | 5452.66 | 7096 | 5453.48 | 9714 | 5454.86 | 12938 | 5456.31 | 23061 |
| 630 | 345 | 25430 | 5448.9 | 5455.01 | 4416 | 5455.78 | 7096 | 5456.43 | 9714 | 5457.44 | 12938 | 5459.05 | 23061 |
| 640 | 515 | 25945 | 5453.0 | 5459.52 | 4416 | 5460.37 | 7096 | 5461.02 | 9714 | 5461.60 | 12938 | 5463.39 | 23061 |
| 650 | 230 | 26175 | 5456.8 | 5461.36 | 4416 | 5462.08 | 7096 | 5462.67 | 9714 | 5463.32 | 12938 | 5464.88 | 23061 |
| 660 | 330 | 26505 | 5459.6 | 5465.58 | 4416 | 5466.24 | 7096 | 5466.77 | 9714 | 5467.35 | 12938 | 5468.86 | 23061 |
| 670 | 450 | 26955 | 5465.5 | 5470.74 | 4416 | 5471.22 | 7096 | 5471.63 | 9714 | 5472.09 | 12938 | 5473.33 | 23061 |
| 680 | 265 | 27220 | 5468.0 | 5474.05 | 4416 | 5474.81 | 7096 | 5475.75 | 9714 | 5476.07 | 12938 | 5477.20 | 23061 |
| 690 | 395 | 27615 | 5472.5 | 5481.11 | 4416 | 5481.96 | 7096 | 5482.54 | 9714 | 5483.21 | 12938 | 5484.51 | 23061 |
| 695 | 380 | 27995 | 5477.5 | 5484.63 | 4416 | 5485.59 | 7096 | 5486.45 | 9714 | 5487.33 | 12938 | 5489.43 | 23061 |
| 700 | 420 | 28415 | 5487.2 | 5489.74 | 4416 | 5490.17 | 7096 | 5490.60 | 9714 | 5491.14 | 12938 | 5492.36 | 23061 |

## FOUR-MILE CREEK'S BANK-OVERFLOWED CHANNEL

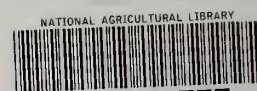
|      |     |      |        |         |    |         |      |         |      |         |      |         |       |
|------|-----|------|--------|---------|----|---------|------|---------|------|---------|------|---------|-------|
| 1400 | 0   | 0    | 5297.0 | 5298.15 | 58 | 5299.61 | 2749 | 5299.95 | 5377 | 5300.17 | 8612 | 5300.81 | 18944 |
| 1500 | 390 | 390  | 5293.0 | 5298.22 | 58 | 5300.31 | 2749 | 5300.90 | 5377 | 5301.43 | 8612 | 5302.54 | 18944 |
| 1600 | 385 | 775  | 5294.0 | 5298.22 | 58 | 5300.41 | 2749 | 5301.06 | 5377 | 5301.64 | 8612 | 5302.86 | 18944 |
| 1700 | 450 | 1225 | 5295.0 | 5298.22 | 58 | 5300.52 | 2749 | 5301.23 | 5377 | 5301.85 | 8612 | 5303.13 | 18944 |
| 1800 | 360 | 1585 | 5297.5 | 5298.22 | 58 | 5300.66 | 2749 | 5301.44 | 5377 | 5302.12 | 8612 | 5303.52 | 18944 |
| 1900 | 395 | 1980 | 5299.0 | 5299.97 | 58 | 5301.98 | 2749 | 5302.55 | 5377 | 5303.16 | 8612 | 5304.57 | 18944 |
| 2000 | 270 | 2250 | 5301.0 | 5301.77 | 58 | 5304.24 | 2749 | 5305.19 | 5377 | 5305.93 | 8612 | 5308.19 | 18944 |







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